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Games My PE Instructors Never Taught Me

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Abstract
This essay addresses four questions — 1) Are Pareto Efficient outcomes desirable? 2) Are they efficient? 3) Is Pareto Efficiency a useful concept? 4) Is it useful for public policy study? I will explore these issues by looking at effects of (a) differ ences in persons' goals, (b) preferences for means used to attain goals, (c) limiting resources, (d) externalities, (e) inter-personal compari sons, (f) political contributions, (g) merit goods, (h) universal hedonism, (i) sacred values, (j) concern for equity, (k) cardinality vs. ordinality of utility and social welfare functions, and (^) theory of second best. One's answers to these four questions depend upon one's beliefs (i.e., one's perceptions of what is) and upon one's values (i.e., conception of what ought to be).

Disciplines
Business Administration, Management, and Operations | Economic Policy | Other Public Affairs, Public Policy and Public Administration | Policy History, Theory, and Methods

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I know so many questions--
and so few answers.

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This essay addresses four questions --

1) Are Pareto Efficient outcomes desirable?

2) Are they efficient?

3) Is Pareto Efficiency a useful concept?

4) Is it useful for public policy study?

I will explore these issues by looking at effects of (a) differences in persons' goals, (b) preferences for means used to attain goals, (c) limiting resources, (d) externalities, (e) inter-personal comparisons, (f) political contributions, (g) merit goods, (h) universal hedonism, (i) sacred values, (j) concern for equity, (k) cardinality vs. ordinality of utility and social welfare functions, and (ℓ) theory of second best. One's answers to these four questions depend upon one's beliefs (i.e., one's perceptions of what is) and upon one's values (i.e., conception of what ought to be).

The "PE" in the title means Pareto Efficient or Pareto Efficiency. The first part of the paper uses box diagrams and simple mathematics to investigate questions (1) through (4) in 2-dimensional situations. The second part of the paper investigates these questions in multi-dimensional situations. The next part questions whether competitive outcomes can be PE. The fourth part of the paper draws some inferences from theory of second best concerning desirability, efficiency, and usefulness of PE. The paper ends with a summary section.

Some people have incorporated risk into their studies of PE and found limitations on PE in a risky world. This paper deals with a simpler, risk-free world.

At numerous points in this paper I will want to compare two ratios, which can be written α_1/β_1 and $(\alpha_1 + \alpha_2)/(\beta_1 + \beta_2)$, where α_1/β_1 is a MRT or MRS. Assuming α_1 and β_1 are non zero,

$$\alpha_1/\beta_1 = (\alpha_1 + \alpha_2)/(\beta_1 + \beta_2) \text{ if and only if } \alpha_1/\beta_1 = \alpha_2/\beta_2$$

$$\text{or } \alpha_2 = \beta_2 = 0.$$

I will continually use the phrases "We economists do this" or "we do not do that." This is a sort of a short-hand. Sometimes it will mean "we all do this or do not do that." Sometimes it will mean "almost all of us do or do not." I will also distinguish between "classical PE conditions" and "PE conditions" or "PE outcomes." The former expression means "conditions of a Pareto optimum under the traditional, (textbook) assumptions," i.e., marginal rate of technical transformation equals consumer's marginal rate of substitution everywhere. The last two expressions mean "satisfying the Pareto requirement of making no one worse off while making someone better off under the assumptions I am making in this particular model" or "conditions that maximize the social welfare function I am assuming in this model."

If anyone chooses to read this paper, be forewarned. I wrote this paper for an audience of one--me--to help me organize my thoughts and to discover what I knew.

TWO DIMENSIONAL SITUATIONS

This part of the paper investigates 2-dimensional situations by use of box diagrams or simple optimization analysis.

If People Prefer Some Means Over Others

I first show that satisfaction of classical PE conditions for efficient production by two single-product firms actually creates inefficiency if firms value means as well as ends.

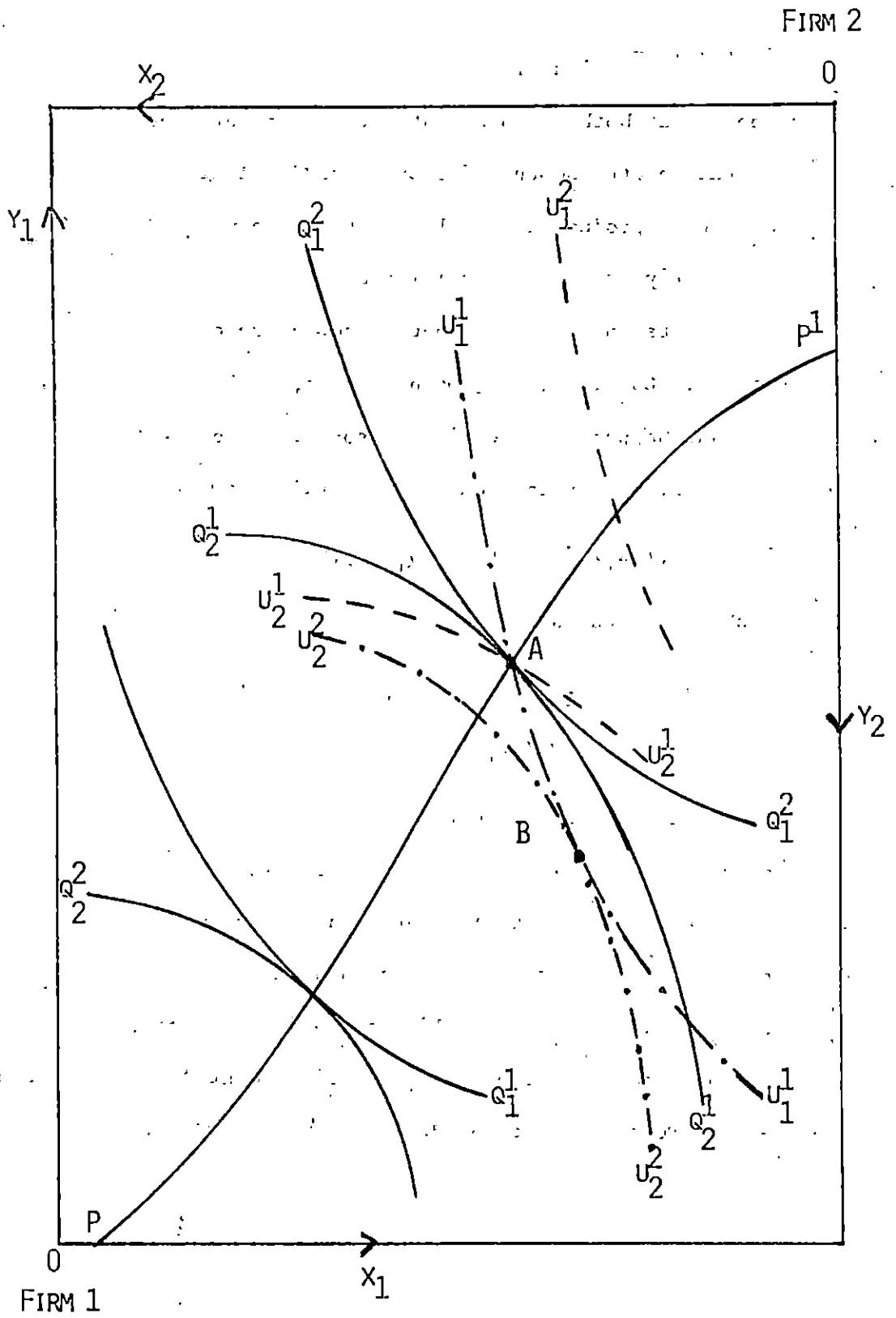
Figure 1 presents the familiar Edgeworth Box diagram for production. Firm 1 uses two inputs to produce output according to the production function $q_1 = f_1(x_1, y_1)$. Firm 2 uses two inputs to produce output according to $q_2 = f_2(x_2, y_2)$. Fixed amounts x and y of the two resources are used: $x_1 + x_2 = x$; $y_1 + y_2 = y$. The curves labelled q_1^i are some of firm 1's isoquants. The larger the value of i, the greater the output. Curves labelled q_2^j are firm 2's isoquants. The larger the value of j the greater the output. All points on curve PP^1 are efficient production points because no more of one good can be produced without producing less of the other at any point on PP^1. Along PP^1,

$$(1) \quad MRTS^1_{xy} = MRTS^2_{xy}$$

where $MRTS^k_{xy}$ represents marginal rate of technical substitution between inputs x and y in firm k.

At any point on an isoquant of firm 1,

FIGURE 1.


FIRM 2
X_2
0
Y_1
Q_1^2
U_1^2
U_1^1
P^1
Q_2^1
U_2^1
U_2^2
A
Y_2
U_2^1
Q_1^2
B
Q_2^2
Q_1^1
U_1^1
Q_2^1
U_2^2
P
0
X_1
FIRM 1

$$dq_1 = 0 = f_{1x}dx_1 + f_{1y}dy_1$$

where $f_{1x} = \partial q_1/\partial x_1$. The slope of the isoquant is

$$(2) \quad (dy_1/dx_1)_q = - f_{1x}/f_{1y}$$

Now suppose that both firms are utility maximizers whose utility depends on output and the amount of input y used. That is, input 2 produces 2 outputs: product and utility. Firm i maximizes $U_i[f_i(x_i, y_i), y_i]$ where $\partial U_i/\partial y_i$ = marginal utility of $y_i > 0$.

Different points on the same isoquant now represent different levels of utility. Consider, say, point A on q_1^2. All points on q_1^2 satisfy (1). What happens to the firm's iso-utility curve through A as we move away from A? All points on the iso-utility curve satisfy

$$dU_1 = (\partial U_1/\partial x_1)\, dx_1 + (\partial U_1/\partial y_1)\, dy_1$$

From this we obtain as the slope

$$(3) \quad (dy_1/dx_1)_U = -[f_{1x}\partial U_1/\partial q_1]/[f_{1y}(\partial U_1/\partial q_1) + (\partial U_1/\partial y_1)]$$

Comparison of (2) and (3) shows that the slope of the iso-utility curve through point A can differ from the slope of the isoquant through that point. Suppose that the iso-utility curve through A (curve U_1^1) is steeper than curve q_1^2 and let U_1^2 represent a higher level of utility than U_1^1. Let U_2^1 be firm 2's iso-utility curve through point A and let U_2^2 represent a higher level of utility than U_2^1. Point A is on PP^1 and is therefore PE. Point B is not on PP^1 and is not PE. But notice that

firm 2 prefers point B because it is on a higher iso-utility curve than point A, and firm 1 is indifferent between A and B. Is PE point A better than non-Pareto point B? It depends on the criterion we use. As we move from B to A we get more product. But we achieve this only at the expense of making firm 2 worse off according to its own values. Aren't points A and B noncomparable according to Paretian criteria? To answer "Is PE desirable?" here we need to use some higher level values to compare desirability of B and A.

The line PP^1 is referred to as the locus of points of efficient production. This label is correct only if "production" is interpreted narrowly. Points on PP^1 are points of efficient production if inputs 1 and 2 are used only to produce product. But the firms use these 2 inputs to produce product and to produce utility. PP^1 is not a locus of points of efficient production of product and of utility.

Figure 2 excludes one likely possibility. The shape of an iso-utility curve depends on the effects of x_i and y_i on output and on utility. It is then possible that isoutility curves are not everywhere convex to the origin. It is possible that firm 2's isoutility curves are nowhere tangent to firm 1's iso-utility curves in the convex range of the latter. Then there exist no PE points, if efficiency is defined in terms of the firms' own objectives.

This argument shows that the classical PE condition that calls for each pair of firms to equate their MRT's in resource use creates inefficiency if either firm values means as well as ends. This can also be shown in various other ways. One way is to compare a situation in which firm one maximizes its profit subject to a restriction on firm two's

profit with a situation in which firm one maximizes utility subject to a restriction on firm two's utility. Comparison of Models MI-1 and MI-2 is another.

Model MI-1

In this model, q_2 is fixed at $\bar{q}_2$ and firm one maximizes output of item one subject to restrictions on x and y. The Lagrangean is

$$L = q_1 + \lambda_1(f_1(x_1,y_1) - q_1) + \lambda_2(f_2(x_2,y_2) - \bar{q}_2)$$
$$+ \mu_x(x-x_1-x_2) + \mu_y(y-y_1-y_2)$$

From manipulation of the first-order conditions (FOC), we obtain

$$\frac{\partial f_1/\partial y_1}{\partial f_1/\partial x_1} = \frac{\partial f_2/\partial y_2}{\partial f_2/\partial x_2} = \frac{\mu_y}{\mu_x}$$

Varying $\bar{q}_2$ provides PP'. At a PE point the two MRT are equal.

Model MI-2

Model MI-2 fixes $U_2(q_2,y_2)$ at $\bar{U}_2$ and maximizes $U_1(q_1,y_1)$. The Lagrangean is

$$L = U_1(q_1,y_1) + \lambda_1(f_1(x_1,y_1) - q_1)$$
$$+ \lambda_2(f_2(x_2,y_2) - q_2) + \lambda_3(U_2(q_2,y_2) - \bar{U}_2)$$
$$+ \mu_x(x-x_1-x_2) + \mu_y(y-y_1y_2).$$

Manipulation of the FOC yields

$$\frac{\partial U_1/\partial y_1 + \lambda_1 \partial f_1/\partial y_1}{\lambda_1 \partial f_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\lambda_2 \partial f_2/\partial y_2 + \lambda_3 \partial U_2/\partial y_2}{\lambda_2 \partial f_2/\partial x_2}$$

which can also be written

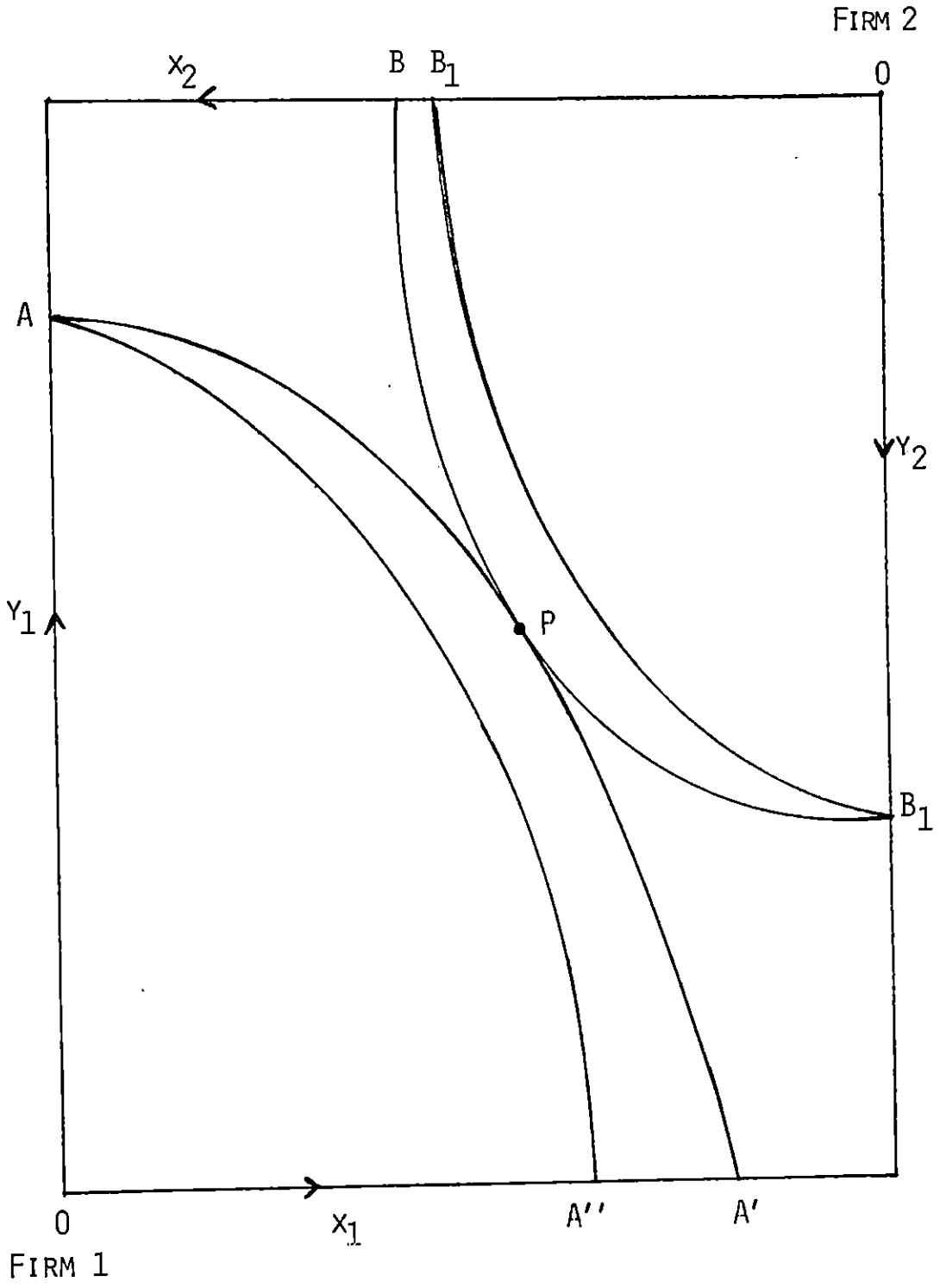
$$\frac{\partial f_1/\partial y_1}{\partial f_1/\partial x_1} = \frac{\mu_y}{\mu_x} - \frac{\partial U_1/\partial y_1}{\mu_x}$$

$$\frac{\partial f_2/\partial y_2}{\partial f_2/\partial x_2} = \frac{\mu_y}{\mu_x} - \frac{\lambda_3 \partial U_2/\partial y_2}{\mu_x}$$

The SWF is not maximized by equating the two MRT. Requiring either firm to equate MRT to the exchange ratio μ_x/μ_y forces inefficiency upon that firm.

We next show that the classical PE conditions for two-product firms generates inefficiency if firms value means as well as ends. Let x_1 and y_1 represent firm 1's production of two goods and let x_2 and y_2 represent firm 2's production. In Figure 2, AA' and BB_1 are firm 1's and firm 2's transformation curves. At point P they are tangent; this is the Pareto-efficient point. But what happens if the firms enjoy producing good x or produce it for status purposes, but produce good y only to make money. Suppose that lines AA'' and B_1B_1 are the firms' utility transformation curves. For each value of x_1, AA'' shows the feasible value of y that maximizes firm 1's utility. For a fixed output of product 1 of firm 1, the maximum amount of product 2 that the firm can produce is on line AA'. But the amount that the firm prefers to produce is on line AA''. The firm is better off according to its own values if it operates along AA'' than if it operates along AA'. B_1B_1 is similarly interpreted for firm 2. AA'' and B_1B_1 are nowhere tangent to

FIGURE 2.



each other. If we move the origin for firm 2 southeast to bring A'' and B_1B_1 into tangency, total output of each product is less at this tangency point than at P. This point of tangency is not PE, but each firm produces more utility for itself at this point than at P. Here, as in Figure 2, the PE point is efficient for production of goods, but not for production of goods and of utility.

Another way to compare the effect of firm objectives on a two-product firm is with models MI-3 and MI-4.

Model MI-3

The firm uses a single variable input to produce two products for maximum profit. The Lagrangean is

$$L = p_1q_1 + p_2q_2 - p_x(x_1 + x_2) + \lambda_1(f_1(x_1) - q_1) + \lambda_2(f_2(x_2) - q_2)$$

The FOC yield

$$\frac{\partial f_2/\partial x_2}{\partial f_1/\partial x_1} = \frac{p_1}{p_2}$$

The MRT equals the product price ratio.

Model MI-4

The firm uses a variable input to produce two products for maximum utility. The Lagrangean is

$$L = U(\pi,q_1) + \lambda_1(f_1(x_1) - q_1) + \lambda_2(f_2(x_2) - q_2) + \lambda_3(p_1q_1 + p_2q_2 - p_x(x_1 + x_2) - \pi)$$

Manipulation of the FOC yields

$$\frac{\partial f_2/\partial x_2}{\partial f_1/\partial x_1} = \frac{p_1}{p_2} + \frac{\partial U/\partial q_1}{p_2(\partial U/\partial \pi)}$$

The MRT does not equal the product price ratio. A profit maximizing firm equates its MRT to the reciprocal of the product price ratio. The utility maximizing firm does not equate MRT to the reciprocal of the price ratio. Forcing the utility-maximizing firm to equate MRT to the price ratio generates inefficiency.

To compare effect of objective function on PE conditions for consumers, we compare MI-5 and MI-6.

Externalities

The next models show that satisfaction of classical PE conditions generates inefficiency in the presence of externalities in consumption or production.

Model MI-5

Each consumer's utility is affected by his own consumption. The quantities of x and y are divided between two consumers to maximize one consumer's utility while the other's is fixed. The Lagrangean is

$$L = U_1(x_1,y_1) + \lambda_1\left(U_2(x_2,y_2) - \bar{U}_2\right) + \mu_x(x-x_1-x_2) + \mu_y(y-y_1-y_2)$$

The well-known PE conditions are

$$\frac{\partial U_1/\partial y_1}{\partial U_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\partial U_2/\partial y_2}{\partial U_2/\partial x_2}$$

The two consumer's MRS are equal.

Model MI-6

Here the utility of consumer one is affected by consumer two's level of consumption of y. The Lagrangean is

$$L = U_1(x_1, y_1 y_2) + \lambda_1(U_2(x_2, y_2) - \bar{U}_2)$$

$$+ \mu_x(x - x_1 - x_2) + \mu_y(y - y_1 - y_2)$$

Here the FOC yield as the PE conditions the relations

$$\frac{\partial U_1/\partial y_1}{\partial U_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\partial U_1/\partial y_2 + \lambda_1 \partial U_2/\partial y_2}{\lambda_1 \partial U_2/\partial x_2}$$

The two consumer's MRS are not equal.

In summary, by comparing MI-1 with MI-2, MI-3 with MI-4, and MI-5 with MI-6, we see that a firm or consumer that fails to equate MRS or MRT to the price ratio, i.e., fails to satisfy the classical PE conditions, is not operating inefficiently if its goal is different from the one we attribute to it. If we promote a policy that meets the classical PE conditions, we are forcing economic agents who value means as well as ends and consumers who value other persons' consumption levels to deviate from their own best interests.

Model MI-7

This is like MI-1 except that the amount of y_2 used affects q_1 and q_2. The term $\lambda_1(f_1(x_1, y_1) - q_1)$ is replaced by $\lambda_1(f_1(x_1, y_1, y_2) - q_1)$. Manipulation of the FOC produces

$$\frac{\partial f_1/\partial y_1}{\partial f_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\lambda_1 \partial f_1/\partial y_2 + \lambda_2 \partial f_2/\partial y_2}{\lambda_2 \partial f_2/\partial x_2}$$

The presence of the externality--the effect of the use of input y by firm two upon firm one's production--requires that firm two not equate its MRT to firm one's MRT.

Scarce Resources

We can also show that the classical PE conditions prescribe inefficient solutions if firms possess limiting quantities of fixed resources. First take the situation of two single product firms.

Model MI-8

If either firm's use of inputs x and y is limited by its stock of a third input, the classical PE condition that firms equate their MRT's describes an inefficient outcome. This is shown in Models MI-8 and MI-9.

Assume that each firm in MI-1 uses a third resource, which is fixed in quantity at G_{i0} and limits the use of x and y. Then we add to the Lagrangean of MI-1 the two terms

$$\rho_1(G_{10} - G_1(x_1,y_1)) + \rho_2(G_{20} - G_2(x_2y_2))$$

Now

$$\frac{\lambda_1 \partial f_1/\partial y_1 - \rho_1 \partial G_1/\partial y_1}{\lambda_1 \partial f_1/\partial x_1 - \rho_1 \partial G_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\lambda_2 \partial f_2/\partial y_2 - \rho_2 \partial G_2/\partial y_2}{\lambda_2 \partial f_2/\partial x_2 - \rho_2 \partial G_2/\partial x_2}$$

$\rho_i = \partial q_i/\partial G_{i0}$ and $\rho_i \geq 0$ if firm i is fully utilizing its fixed resource.

If, say, firm one is fully utilizing its fixed resource and $\rho_1 > 0$

but firm two is not fully utilizing its fixed resource, the FOC call for satisfying

$$\frac{\lambda_1 \partial f_1/\partial y_1 - \rho_1 \partial G_1/\partial y_1}{\lambda_1 \partial f_1/\partial x_1 - \rho_1 \partial G_1/\partial x_1} = \frac{\mu_y}{\mu_x} = \frac{\partial f_2/\partial y_2}{\partial f_2/\partial x_2}$$

We next show the effect of a limiting resource on a two-product firm.

Model MI-9

This model is obtained from MI-3 by adding the constraint $k-a_1q_1-a_2q_2 \geq 0$ where k is the total available amount of a limiting resource and a_i is the amount of that resource used per unit of output i. The Lagrangean is obtained by adding $\lambda_3(k-a_1q_1-a_2q_2)$ to the Lagrangean for Model MI-3. Manipulation of FOC yields

$$\frac{\partial f_2/\partial x_2}{\partial f_1/\partial x_1} = \frac{\lambda_3 a_1 - p_1}{\lambda_3 a_2 - p_2}$$

Summary

For classical PE points to create inefficiencies it is not necessary for all firms to value some means as well as ends, for all firms to face externalities, for all firms to have limiting resources, for all firms to face different input prices, and for all consumers to be affected by other persons' levels of consumption. It is only necessary for some firms to value means as well as ends, or for some firms to face externalities, or for some firms to have limiting resources, or for some firms to face different input prices (or different output prices for homogeneous products), or for some consumers to be affected by other

consumers. If an economy does contain any firms or consumers that have these characteristics and are behaving efficiently according to their own criteria, we know from the theory of second best that having others satisfy the classical PE does not assure an efficient outcome. It provides at most a third best situation.

Lobbying Expenditures

One thing missing from most treatments of PE is explicit inclusion of governmental behavior and of citizens' efforts to affect it. I turn now to a look at some simple models of lobbying expenditures and political contributions.

Model MI-10

The individual is assumed to maximize the utility function $U(X,C)$ subject to $X \geq 0$, $C \geq 0$ and $(1-t) \leq p_x X + p_c C$ where X is all goods, C is political contribution, and t is income tax rate. I assume $p_c = (1-t)/2$. Why would a person's utility be affected by contributing to the political process? Perhaps because of a belief that every citizen has a responsibility to participate in the political process and a feeling of satisfaction that comes from meeting that responsibility. Merit wants and merit goods will be discussed later in this paper. A person might want to make political contributions to influence governments' choices of merit goods.

First, suppose $X > 0$ and $C = 0$. Then $U_x = \lambda p_x$ and $(U_c - \lambda p_c) < 0$. Assume the strict inequality holds. Then the marginal utility obtained from contributing \$1 to political action is less than the marginal

utility obtained from the alternative use of the dollar. As I rises, however, λ falls until $U_c - \lambda p_c = 0$ and $C > 0$.

Assume $C > 0$. By totally differentiating the (equality) income constraint and the (equality) FOC with respect to income we can find the effect of I upon C. Assume $U_{xc} = 0$, i.e., the marginal utility of goods consumption is independent of the level of C. Then we can derive

$$\partial C/\partial I = \mu U^{cc}(t-1)^2/2$$

where

$$\mu = (p_x, (1-t)/2)\begin{pmatrix} U^{xx} & 0 \\ 0 & U^{cc} \end{pmatrix}\begin{pmatrix} p_x \\ (1-t)/2 \end{pmatrix}$$

$$> 0$$

$U^{xx} = 1/U_{xx} < 0$. Also $U^{cc} = 1/U_{cc} < 0$. We find that $\partial C/\partial I > 0$. Personal political contributions increase as I increases.

By totally differentiating the income constraint and the FOC with respect to t, we can obtain the effect of variation in the tax rate on C. The result is

$$\partial C/\partial t = \mu U^{cc}(I-C/2)(1-t)/2$$

$$- (U^{cc} + \mu p_c^2 U^{cc^2}) \cdot \lambda/2$$

The first line on the right-hand side of this expression is positive if $I > C/2$. The term in parentheses on the second line is also negative because it is a main diagonal element of a negative semidefinite matrix;

the second row is therefore positive. Hence $\partial C/\partial t > 0$. Increasing t reduces the consumer's disposable income. But it also reduces the implicit price of political contributions. The net effect is to increase political contributions.

(As an aside I want to note that defining p_c as a decreasing function of t destroys homogeneity of demand functions, raises a question about the definition of compensated demand, and generates nonsymmetric substitution terms.)

For persons in a position to do so, it may be more effective to make one's political contributions at second hand so to speak by having the firm that one manages or owns make political contributions. I now look at some simple models of political contributions by firms.

Model MI-11

The Christian Science Monitor [Knickerbocker, 1985] reported

> "MX [Missile] and SDI [Strategic Defense Initiative or "star wars"] contractors were also paying close attention to last November's election. The Center on Budget and Policy Priorities issued an analysis of Federal Election Commission data Wednesday showing that political-action committees sponsored by such contractors gave more than $900,000 to congressional candidates.
>
> Nearly 60 percent of the money went to the eight members of the Senate Armed Services Committee and Senate Defense Appropriations Subcommittee up for reelection. The top recipient ($73,549) was Sen. John Warner (R) of Virginia, a strong MX supporter, who heads the Armed Services subcommittee on strategic and theater nuclear forces. Ironically, the next two top recipients, Republicans Charles H. Percy of Illinois and Roger W. Jepsen of Iowa, lost their reelection bids."

This suggests the following simple model,

$$\pi = R(q) - C(q) - L;\ \partial q/\partial L > 0$$

where R(q) and C(q) are total revenue and total costs and L is lobbying and political campaign expenditures intended to increase government purchases of the firm's product.

$$\partial\pi/\partial L = (\partial R/\partial q - \partial C/\partial q)(\partial q/\partial L) - 1 = 0$$

or

$$MR - MC = 1/(\partial q/\partial L) > 0$$

The firm operates at a level of output at which MR > MC and does not operate at a PE point. Theory of second best tells us that a society containing such firms is not efficient if it requires PE elsewhere.

Model MI-12

Consider now a single product firm that is subject to a tax on profits and that can affect the tax rate by political expenditures.

$$\pi = \big(R(q) - C(q) - L\big)(1-t);\ t = t(L);\ \partial t/\partial L \leq 0$$

Allowing L to be zero or positive,

$$\partial\pi/\partial L = -(R-C-L)(\partial t/\partial L) - (1-t) \leq 0$$

$$L(\partial\pi/\partial L) = 0$$

I first establish that $\partial t/\partial L = 0$ implies $L = 0$. If $\partial t/\partial L = 0$,

$$\partial\pi/\partial L = -(1-t) < 0$$

So L = 0. But I observe that businessmen do spend money to affect tax rates, so I conclude that L > 0. And L > 0 then implies $\partial\pi/\partial L = 0$. The

fact that we observe businessmen using resources to affect tax rates implies that their efforts do affect tax rates. If $\partial\pi/\partial L = 0$, L can be positive.

Now assume $L > 0$ and $\partial t/\partial L < 0$. Define $\eta = (\partial t/\partial L)(L/t)$, the elasticity of tax rate w.r.t. L. Then

$$R-C-L = L\left(\frac{1}{\eta}\right)\left(\frac{t-1}{t}\right) > 0$$

$R-C-L>0$. Also

$$L = \frac{R-C}{1 + \frac{1}{\eta}\left(\frac{t-1}{t}\right)}$$

If the excess of revenue over variable costs increases, the firm increases its political expenditures. This is shown also in model MI-13.

Model MI-13

This is a variation of MI-12. It is assumed that $p = p(q,\alpha)$, where α is a parameter in the demand function and $\partial p/\partial\alpha > 0$, and $R = pq$. Following the argument of MI-12, L is assumed positive. The FOC are

$$\partial\pi/\partial q = (1-t)\ (MR-MC) = 0$$

$$\partial\pi/\partial L = -\ (R-C-L)\ \partial t/\partial L\ -(1-t) = 0$$

The SOC terms are

$$\partial^2\pi/\partial q^2 = (1-t)\ \partial^2(MR-MC)/\partial q^2 < 0$$

$$\partial^2\pi/\partial q\partial L = -(MR-MC)(\partial t/\partial L) = 0$$

$$\partial^2\pi/\partial L^2 = 2\,\partial t/\partial L - \pi\partial^2 t/\partial L^2 < 0$$

Differentiating the FOC w.r.t. α and solving yields

$$\frac{\partial L}{\partial \alpha} = \left(2\frac{\partial t}{\partial L} - \pi\frac{\partial^2 t}{\partial L^2}\right)^{-1}\frac{\partial t}{\partial L}\,q\,\frac{\partial p}{\partial \alpha} > 0$$

This is positive because the term in parentheses is negative, $\partial t/\partial L < 0$, and the last two terms are positive. Exogenous increases in demand lead to increased expenditures aimed at reducing the profits-tax rate.

Model MI-14

This section looks at a firm that can reduce its costs by increasing its lobbying expenditures and/or political campaign contributions. By increasing its political expenditures it can, e.g., get cheaper irrigation water, cheaper barge travel on the Mississippi, or lower labor costs. This section also looks at the effect of changing the way profits are measured for tax purposes.

The first version of the model is

$$R = pq;\ p \text{ constant}$$

$$C = C(q,L),\ \partial C/\partial L < 0$$

$$\pi = (1-t)(R-C-L)$$

The relevant FOC is

$$\partial\pi/\partial L = -(1-t)(\partial C/\partial L + 1) = 0.$$

The latter implies $\partial C/\partial L = -1$. The SOC are

$$\partial^2\pi/\partial q^2 = -(1-t)\ \partial MC/\partial q < 0$$

$$\partial^2\pi/\partial q\partial L = -(1-t)(\partial MC/\partial L)$$

$$\partial^2\pi/\partial L^2 = -(1-t)(\partial^2 C/\partial L^2) < 0$$

The latter implies $\partial^2 C/\partial L^2 > 0$.

The second version is

$$\pi = (1-t)\ (R-C) - L$$

otherwise the same as the first. The firm in this model cannot subtract lobbying expenses before computing profit tax liability. Now

$$\partial\pi/\partial L = -(1-t)(\partial C/\partial L) - 1$$

The latter implies $\partial C/\partial L = -1/(1-t)$. Now

$$-1 > -1/(1-t).$$

$\partial C/\partial L$ is larger (closer to zero) under the first law than under the second. Because $\partial C/\partial L < 0$ and flattens out as L increases, this implies that L is larger under the first law than under the second. The firm's political expenditures are larger if they are deductible for tax purposes than if they are not deductible.

This argument and the later discussion of Figure 3 show that we should not confuse Pareto-efficiency with ethically desirable. PE points are determined by existing values as reflected in demand functions for marketed goods and by existing distribution of factor-ownership. The latter is determined by market forces, by tax laws, and by laws of property rights. If you have ethical objections to existing

market-expressed values, to existing distribution of factor ownership, to existing tax laws, then you can logically conclude that Pareto efficiency deviates from ethically desirable.

Pareto efficiency takes existing distributions of income, factor ownership, and property rights as given. Because of the existence of a high income-elasticity and a high wealth-elasticity of demand for political representation, the rich can afford, and have strong incentive, to make substantial political expenditures. They finance efforts to influence the laws that determine distribution of income, factor-ownership, and property rights in ways favorable to themselves. By doing so, they obtain favorable tax laws; favorable tax treatment for depreciation, depletion, and exploration expenses; less restrictive regulations by EPA and OSHA; etc. How can we know that PE is efficient unless we know that the laws that result from these efforts contribute to achieving efficiency? "Once organizations have become large, they necessarily acquire the power to interfere with the political process that is supposed to bust them" [Maris, 1972, p. 113]. And what about the tax-shelter industry that is created by legislative acts? Kaiser [1984, p. 1C] wrote

> If any further evidence were needed to prove that the rich are different, the tax-shelter industry--that's the right word, industry--provides it.
>
> Here's a phenomenon ... which keeps thousands of accountants and lawyers busy distorting the national economy in a variety of ways.

When we base public policy decisions on existing income distribution we grant to the winners in the economic arena the right to set the rules in the political arena that determine the next outcome in the

economic arena. After all, one modern version of the Golden Rule is "Those who have the gold make the rules."

Interpersonal Comparisons

The strong appeal of PE rests on the premise that its use allows us to make statements about welfare without making inter-personal comparisons. This premise is doubly false. I will demonstrate two kinds of interpersonal comparisons of utility that are made in PE analysis. When we take the position that PE points are superior to non-PE points we are making an interpersonal comparison in the form of an assertion that people who value only ends should get what they want but people who value means and ends should not get what they want. This is easily demonstrated by Figure 2. According to PE criteria, the most desirable outcomes are on the contract curve PP^1. This is consistent with the desires of people who value only ends. If they are at a point off PP^1, they can both become better off by a move to PP^1. But if the firms value means and ends they would rather not be on PP^1. They would prefer to be on the "utility contract curve" that passes through points of tangency of their iso-utility curves. If we assert that points on PP^1 are superior to points off PP^1, including points that are on the utility contract curve, we are asserting that it is undesirable for firms that value means to get what they want: they should get what we decide is good for them. This assertion can be easily generalized. Whenever we assume all people are of Type X and apply PE type criteria we are making the value judgment: It is desirable that Type X people get what they want but that non-Type X people not get what they want.

Comparison of results of Models MI-1, -3, and -5 with Models MI-2, -4, and -6, respectively can also be used to substantiate this generalization.

The previous discussion on externalities in PE shows that our standard PE criteria contain a second interpersonal comparison, one that discriminates against individuals whose utility is influenced by externalities. The marginal utilities of all arguments of a person's utility function are relevant if the person is indifferent to externalities. But only some arguments of a person's utility function are relevant if the person's welfare is affected by externalities.

Almost invariably we derive PE conditions under the assumption that people are indifferent toward the use made of their resources: that their utility depends upon levels of consumption and is independent of the way their resources are employed to finance their consumption. People do have preferences concerning the kind of work that they do. And some investors prefer some kinds of investments over others: e.g., local businesses over multinational corporations. In deriving PE conditions under the assumption that people are indifferent to the use made of their resources we assert that it is desirable that people who are indifferent should get what they want but people who do prefer some uses of their resources over others should not get what they want.

The PE conditions are necessary conditions for the maximization of a Bergson-Samuelson Social Welfare Function. (See Mueller [1979, pp. 174, 183] and Streeten in Myrdal [1958, p. xxv].) If we use such a function our argument makes the shocking assertions: in order to maximize welfare it is necessary to discriminate against people who value

means and to discriminate against people whose utility functions contain externalities as arguments.

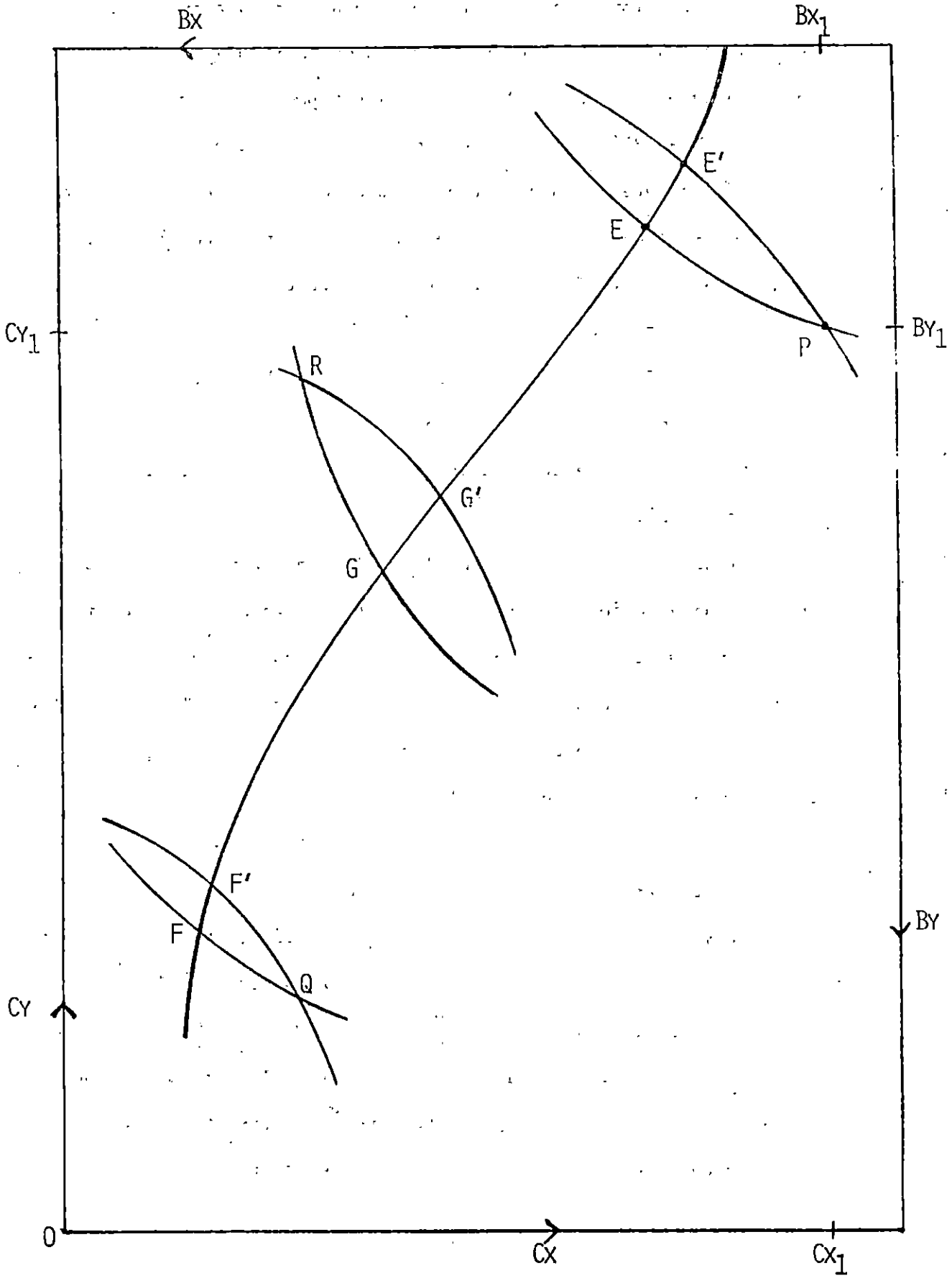
The dependence of PE outcomes upon distribution of income or resource ownership can be shown by use of a box diagram. Suppose that unbeknownst to Robinson Crusoe, another castaway--Mr. Bligh--lives on the other side of the Crusoe's island. On Bligh's side, growing conditions are less favorable than on Crusoe's side. The men apply equal knowledge, intelligence and diligence but Bligh harvests only Bx_1 and By_1 of products X and Y whereas Crusoe harvests Cx_1 and Cy_1. See Figure 3. After harvest, the two meet and begin to barter. Neither will accept an outcome that is less favorable than his initial position at point P. The outcome therefore is in the area between the two indifference curves that pass through point P. The line segment EE' is a portion of the contract curve. Movement from P to a point on EE' is a Pareto-improvement. Trading is mutually beneficial, but C started out with more of both X and Y and still has more of both after trading.

Point R represents an initial position if the two sides of the island are equally productive. The outcome of voluntary bargaining is now between the two indifference curves that pass through R. GG' is a portion of the contract curve. A move from R to GG' represents a Pareto-improvement.

Our PE criteria--if we believe them--permits us to assert with certainty that movement from P to EE' or from R to GG' is an improvement. But they do not permit us to say anything about movement from P to GG'.

Suppose that points between the two indifference curves that pass

FIGURE 3.



through P do not allow Bligh to consume enough to stay alive until the next harvest season, whereas they allow Crusoe to indulge his natural gluttony. Assume also that (a) the island's topography makes it easy for Crusoe to keep Bligh off from Crusoe's fruitful side of the island and (b) Crusoe's rate of substitution between gluttony and harvest labor is such that he is unwilling to pay Bligh for helping with harvest. In sum, Crusoe is quite willing for Bligh to starve to death in order to satisfy his own appetites.

Remaining at P or at EE' condemns Bligh to death. But even if movement to GG' would allow both Crusoe and Bligh to live well, none of our present criteria provide a basis for concluding that GG' is preferable to P or to EE'.

Economists generally accept the "as if" method a valid for explanation of human behavior. It is also useful for explaining economists' behavior. By applying it to the preceding paragraph, we see that economists value economic inequality so highly that they are willing to allow poor persons to starve to death in order to maintain inequality. (At least, they behave as if they were.)

If we want to claim that economics deals with human welfare, honesty ought to compel us to admit that it deals with it in a terribly inadequate way so long as its criteria do not permit us to identify the better of (a) an adequate living for all and (b) starvation for some and gluttony for others.

What I want to have explained to me is this. In our PE analyses, we regularly make the value judgment that people whose preference system differs from the one we assume should not get what they want. And we

regularly make another interpersonal comparison: between persons' marginal social significance -- see discussion of Model MA-8 later. Why then can we not develop a criterion that permits us to choose between EE' and GG'?

My Bligh-Crusoe analysis of PE applies to any inequality in resource ownership, including inequality in inherited privilege -- whether the privilege is due to race, IQ, family (being one of the right people), or wealth. Thus PE concludes: differences, even gross ones, in inherited resource endowments lead to efficient outcomes.

PE criteria do not establish that any PE point is superior to any non-PE point, nor that it is superior to any other PE point. To establish PE of a public policy is not sufficient to establish its desirability, even on PE grounds. An economy is always in some initial position. To establish the desirability of adopting a PE policy, it is necessary to establish that the PE point that will result from adoption of the policy is superior to the initial position. We never have enough information to make such a comparison.

There is even an easier way to show that PE depends upon distribution of resource ownership or income. Of the expression "make some people better off without making anyone else worse off," we ask, "better, or worse, off compared with what?" I don't believe that we mean "You will be at least as well off under possible policy A as under hypothetical policy B." In using the phrase "better, or worse, off" the basis for comparison is the status quo: "better, or worse, off than you are now." If no one is to be made worse off than he is at present than the status quo imposes a restriction.

This section has demonstrated the sensitivity of PE to specification error in two-dimensional situations. The next section demonstrates the sensitivity in many-dimensional situations.

MULTIDIMENSIONAL SITUATIONS

To argue that satisfying the classical PE conditions generates inefficiency, I will use Pazner's [1973] model and slight variations thereof.

Classical PE

Model MA-1

Define

x_{jh} = quantity of commodity j consumed by person h; j=1,2,...,J; h=1,2,...,H. (If x_{jh} is an output, its flow is measured by a positive number. If it is an input, its flow is measured by a negative number and amount "consumed" is amount "used in production.")

$X_h = (x_{1h}, x_{2h}, \ldots, x_{Jh})$ = vector of quantities consumed by h-th customer.

$x_j = \Sigma_{h=1}^{H} x_{jh}$ = total consumption of commodity j.

$U_h(X_h) = U_h$ = h-th person's utility function.

$F(x_1, x_2, \ldots, x_J) = F(X)$ = community's implicit transformation function.

$W[U_1(X_1), U_2(X_2), \ldots, U_H(X_H)] = W(U)$ = social welfare function (SWF).

W is assumed to be strictly increasing in each U_h. Because of the sign convention on inputs and outputs this means that W is an increasing function in each x_{jh}. The Lagrangean is

$$L = W(U) - \lambda F(X)$$

An omnipotent, omniscient, and benevolent Welfare Czar is assumed to manipulate the x_{jh} to maximize W(U) subject to F(X) = 0. The first-order conditions can be expressed as

$$(\partial W/\partial U_h)(\partial U_h/\partial x_{jh}) - \lambda \partial F/\partial x_j = 0$$

for all j and h.

If we replace j by i and divide the two equations we obtain from simple manipulation

$$(\partial U_h/\partial x_{ih})/(\partial U_h/\partial x_{jh}) = (\partial F/\partial x_i)/(\partial F/\partial x_j)$$

Because the right-hand side is independent of h (of person), we can also write

$$(\partial U_g/\partial x_{ig})/(\partial U_g/\partial x_{jg}) = (\partial F/\partial x_i)/(\partial F/\partial x_j)$$

These last two equations state the PE condition that the marginal rate of substitution between products i and j be the same for all persons and that this MRS equals the community's MRT.

This formulation, we should note, implicitly contains the classical assumption that productive activities are disvalued. If item j is an input, x_{jh} is a negative number. Because W is strictly increasing in x_{jh}, $\partial U_h/\partial x_{jh} > 0$ means that reducing the supply of input j, e.g., labor and skill, increases person h's utility. Thus the formulation precludes

the possibility that some persons may enjoy utilizing their productive inputs or applying their skills in some activities.

Merit Wants

Model MA-2

Pazner's discussion of merit wants is admirably suited to showing effect of objective on PE solutions. What are merit wants? The terminology is due to Musgrave, who wrote [1976, p. 66]

> Interpreted as a device to provide consumer information, as a means of allowing for externalities, or as an expression of voluntary giving in kind, the merit-good concept falls within the framework of traditional analysis in which efficient allocation must in the end be related to individual choice. But, when interpreted as imposition of preferences of the ruling group or decision makers, allocation on a merit-good basis stands outside what has been dealt with here as the theory of social goods. In all these cases it is evident, however, that interference may apply with regard to private goods (e.g., pornography) no less than to what we have defined as social goods. The social- and merit-good problems must therefore be distinguished.

Pazner [1973, p. 461] writes

> The presence of merit wants means that in the social calculus individual preferences are either neglected altogether or supplemented by other considerations. In other words the implementation of such wants involves to some extent imposing on individuals choices that they would not otherwise make.
>
> In an individualistic setting the only possible rationale for including merit wants in a normative model must be based on the premise of imperfect information, whatever the causes, of members of the society as to the consequences of certain actions. The welfare implication of such imperfect information is that the individual cannot be left sole judge of what is "good" or "bad" for him. We avoid the delicate question of who is likely to know this

> better than him by postulating a perfectly informed elite on the shoulders of which rests the responsibility of social policy.
>
> First, merit wants could arise because the individual has imperfect information of the consequences of his own actions on his welfare. And second, they could arise because he has imperfect information of the consequences of actions taken by other individuals on his own welfare (or, if he "cares" about other members of the society, actions taken by him on the welfare of others.) Only this second category involves merit wants in the form of unaccounted-for-externalities. Nevertheless, merit wants and externalities turn out to be very closely related in their policy implications....

In one formulation, the SWF is affected by aggregate amounts; in another formulation, by their distribution. In the first situation, the SWF is

$$W[U_1(X_1),\ U_2(X_2),\ \ldots,\ U_H(X_H);\ x_1,\ x_2,\ \ldots,\ x_J]$$

Partially differentiating the Lagrangean with respect to x_{jh} yields (because $dx_j = dx_{jh}$)

$$\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{jh}} + \frac{\partial W}{\partial x_j} = \lambda \frac{\partial F}{\partial x_j}$$

And differentiating with respect to x_{ih} and manipulating yields

$$\frac{\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{jh}}}{\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{ih}}} = \frac{\lambda \frac{\partial F}{\partial x_j} - \frac{\partial W}{\partial x_j}}{\lambda \frac{\partial F}{\partial x_i} - \frac{\partial W}{\partial x_i}}$$

If we assume $\partial W/\partial x_i = 0$, then

$$\frac{\partial U_h/\partial x_{jh}}{\partial U_h/\partial x_{ih}} = \frac{\partial F/\partial x_j}{\partial F/\partial x_i} - \frac{\partial W/\partial x_j}{\lambda \partial F/\partial x_i}$$

or

$$MRS^{h}_{ij} = MRT_{ij} + T_{ij}$$

I quote what Pazner [p. 468] wrote because it is also relevant to later material in this paper. He wrote

> the marginal rate of substitution of any consumer for any pair of commodities has to be equated to an entity which is independent of the particular consumer under consideration, and hence is common to all consumers. This immediately suggests treating the expression on the right hand side as a price ratio that would be the same for all consumers. Furthermore, the representation of this price-like expression as a discrepancy from the marginal rate of transformation indicates that unfettered reliance on the competitive price mechanism cannot lead to an optimal outcome. It suggests, rather, that consumers and producers should be made somehow to face different prices....

(My underlining for emphasis.) In the presence of merit goods the SWF cannot be maximized--a PE outcome cannot be achieved--without public action to cause inequality between MRT_{ij} and MRS_{ij}. He also wrote [p. 468]

> the optimum can be reached by using (n-1) producer prices, (n-1) consumer prices and the proper distribution of income implied by the optimum. That is, setting MRT_{ij} (j=1, ..., n; j≠i) as the producer price of commodity j MRS_{ij} as the consumer price, and securing for the optimal distribution of income by means of lump-sums will enable the planner to implement the optimum....

He interprets the discrepancy as an excise tax (or subsidy). If item j is a demerit good $\partial W/\partial x_j < 0$ and T_{ij} is a tax on item j. If item j is a merit good $\partial W/\partial x_j > 0$ and T_{ij} is a subsidy on item j.

Model MA-3

In this model, the SWF of the "perfectly informed elite" is

affected by the distribution of items. The SWF is

$$W[U_1(X_1), U_2(X_2), \ldots, U_H(X_H); x_{11}, \ldots, x_{J1}, x_{12}, \ldots, x_{JH}]$$

Manipulating FOC and assuming $\partial W/\partial x_i = 0$ yields

$$MRS^h_{ij} = MRT_{ij} + T_{ijh}$$

where, now

$$T_{ijh} = -\frac{\partial W/\partial x_{jh}}{\lambda \partial F/\partial x_i}$$

Note that in MA-2, T_{ij} is constant across all individuals, whereas in MA-3, the tax varies among individuals.

Pazner also shows how his formulations can be interpreted in order to deal with environmental pollution and deterioration.

Merit wants and universal hedonism are similar in that each reflects individuals' concern for others. But they incorporate this concern in different ways.

Universal Hedonism

Model MA-4

Pazner follows the classical formulation for each individual's utility function; the assumption of egoistic hedonism. That is, each person is exclusively concerned with his own consumption levels. An obvious alternative is to assume universal hedonism, in which each person's utility is affected by everyone else's levels of consumption. There are gradations between these two, of course. I will first look at universal hedonism. There are two possibilities, that parallel Pazner's

two formulations of merit wants. In one, each person is concerned about level and distribution of goods and services. A person's utility function then becomes $U_h(x_{11},x_{21},\ldots,x_{J1},x_{12},\ldots,x_{J2},\ldots,x_{JH})$, i.e., $U_h(X_1,\ldots,X_h,\ldots,X_H)$. And the SWF is, of course,

$$W[U_1(X_1,X_2,\ldots,X_H),\ U_2(X_1,X_2,\ldots,X_H),\ldots,\ U_H(X_1,X_2,\ldots,X_H)]$$

From the FOC,

$$\frac{\partial U_h/\partial x_{jh}}{\partial U_h/\partial x_{ih}} = \frac{\lambda \partial F/\partial x_j - \sum_{t\neq h}(\partial W/\partial U_t)(\partial U_t/\partial x_{jh})}{\lambda \partial F/\partial x_i - \sum_{t\neq h}(\partial W/\partial U_t)(\partial U_t/\partial x_{ih})}$$

Something new appears in this expression. We can call $\partial W/\partial U_t$ "the marginal social utility", or "marginal social value", or "marginal social significance" of person t. It equals the change in value of the SWF per unit change in the t-th person's utility. Each person's equilibrium MRS_{ij} is a function of the marginal social values of all other persons, and also of all other person's marginal utilities. Suppose that $\partial U_t/\partial x_{ih} = 0$ for all $t \neq h$. Then

$$MRS_{ijh} = MRT_{ij} + T_{ijh}$$

where $$T_{ijh} = -\frac{\sum_{t\neq h}(\partial W/\partial U_t)(\partial U_t/\partial x_{jh})}{\lambda \partial F/\partial x_i} \gtrless T_{ijg}.$$

Persons g and h may be somewhere between egoistic hedonists and universal hedonists. They may be familial hedonists, or racist hedonists, or nationalistic hedonists, e.g. Then the difference between T_{ijg} and T_{igh} can be much greater than if both are universal hedonists.

Let persons g and h be concerned only with consumption levels of people in mutually exclusive groups C_g and C_h respectively. Then the range of summations in T_{ijh} and T_{ijg} become $t \epsilon C_h$, $t \neq h$ and $t \epsilon C_g$, $t \neq g$. Implicit in my use of the concept of universal hedonism is the idea that $\partial U_t / \partial x_{jh} \geq 0$ for all t. If $\partial U_t / \partial x_{jh} > 0$ for some t, T_{ijh} is negative and PE calls for subsidizing person h's consumption of item j.

The facts that we have widespread, even if not universal, public support for a variety of public welfare programs and that individuals do make personal contributions to charity mean to me that some people are universal hedonists, or at least that their concerns are broader than egoistic hedonism. Consequently I infer that MRT = MRS everywhere is not a PE situation.

Limiting Resources

Model MA-5

If society has any fully employed unspecialized resources, its SWF is <u>not</u> maximized by equating society's MRT to every consumer's MRS. To show this, we add to the problem a constraint, $G(X) \leq G_0$, where G_0 is the amount of a scarce resource available to society, and a nonnegative Lagrange multiplier μ, which is the shadow price of the scarce resource. If this resource is fully employed:

$$(\partial U_g / \partial x_{ig}) / (\partial U_g / \partial x_{jg}) = (\lambda \partial F / \partial x_i + \mu \partial G / \partial x_i) / (\lambda \partial F / \partial x_j + \mu \partial G / \partial x_j)$$

The value of μ equals the reduction in the value of the SWF that results from reducing G_0 by one unit. When it is positive, PE does not equate

MRS to MRT. Evaluating the right-hand side of this expression requires knowing much more than society's transformation function. It also requires knowing values of $\partial G/\partial x_i$, $\partial G/\partial x_j$, and the Lagrange multipliers. We conclude that the classical PE condition are cyclical conditions. They are appropriate when society has no limiting resource, but not when society has any fully employed limiting resource. Similarly, the contract curve in Figure 2 is not a set of points of maximum efficiency if either firm's use of x or y is restricted by its ownership of a third resource.

Externalities in Production

Model MA-6

Models MA-2 and MA-3 can be interpreted as incorporating effects of externalities, see Pazner [1973, pp. 469-71]. But the result is an incomplete treatment of externalities because pollution, environmental degradation, and desirable externalities do not enter any individual's utility function in his models. Model MA-4 shows effect of externalities in consumption. MA-6 also explores externalities.

Define

y_j = quantity of externality or by-product turned out by activity that produces x_j

$y_j = f_j(x_j)$

Write each person's utility function as $U_h(X_h, y_1, y_2, \ldots, y_J)$. Then a typical FOC is

$$\frac{\partial W}{\partial U_h}\left(\frac{\partial U_h}{\partial x_{jh}} + \frac{\partial U_h}{\partial y_j}\frac{\partial y_j}{\partial x_j}\right) + \sum_{t\neq h}\frac{\partial W}{\partial U_t}\frac{\partial U_t}{\partial y_j}\frac{\partial y_j}{\partial x_j} - \lambda\frac{\partial F}{\partial x_j} = 0$$

And

$$\frac{\dfrac{\partial U_h}{\partial x_{jh}} + \dfrac{\partial U_h}{\partial y_j}\dfrac{\partial y_j}{\partial x_j}}{\dfrac{\partial U_h}{\partial x_{ih}} + \dfrac{\partial U_h}{\partial y_i}\dfrac{\partial y_i}{\partial x_i}} = \frac{\lambda\partial F/\partial x_j - \dfrac{\partial y_j}{\partial x_j}\displaystyle\sum_{t\neq h}\dfrac{\partial W}{\partial U_t}\dfrac{\partial U_t}{\partial y_j}}{\lambda\dfrac{\partial F}{\partial x_i} - \dfrac{\partial y_i}{\partial x_i}\displaystyle\sum_{t\neq h}\dfrac{\partial W}{\partial U_t}\dfrac{\partial U_t}{\partial y_i}}$$

Here as in MA-4, the FOC for PE for each consumer are affected by the marginal social significance of every other consumer.

To simplify, suppose that production of item i turns out no externality. Then

$$MRS^h_{ij} = MRT_{ij} + T_{ijh}$$

where

$$T_{ijh} = -\frac{\partial y_j}{\partial x_j}\sum_t \frac{\partial W}{\partial U_t}\frac{\partial U_t}{\partial y_j}\Big/(\lambda\partial F/\partial x_i)$$

If $\partial U_t/\partial x_j < 0$, $T_{ijh} > 0$ and maximizing the SWF requires public action, such as levying a tax on item j.

As the individual consumer sees his utility-maximization problem, a typical FOC is

$$\frac{\partial U_h}{\partial x_{jh}} + \frac{\partial U_h}{\partial y_j}\frac{\partial y_j}{\partial x_j} - \mu p_j = 0$$

The individual consumer is such a small part of the total market that he treats $\partial y_j/\partial x_j$ as zero. A Los Angeles motorist, e.g., knows that increasing or decreasing his own use of an automobile will have no

perceptible effect on the smog. Consequently the h-th utility-maximizing consumer operates where

$$\frac{\partial U_h / \partial x_{jh}}{\partial U_h / \partial x_{ih}} = \frac{P_j}{P_i}$$

Only by chance will points that satisfy this equality satisfy the FOC for PE. In a society that contains merit goods or externalities in production or consumption, the only interesting feature of the invisible hand is its invisibility. If the invisible hand maximizes the SWF, individual's utility functions are not maximized. If it allows individuals to maximize their own utility functions, the SWF is not maximized. As Pazner [p. 471] observes, the feature common to cases of merit goods and externalities is that "even though they, generally, present distributional problems, they cannot merely be solved by pure redistributional devices (short of allocating optimal consumption baskets directly to the individuals--i.e., rejecting the market mechanism altogether) and need explicit supplementary pricing policies."

This example demonstrates another characteristic of our hedonism assumption. We not only assume egoistic hedonism, we also assume market, or monetaristic, hedonism. We only allow people to value things that can be bought and sold. The y_j in MA-6 are not marketed so we conventionally exclude them from our investigations.

We can use MA-6 to reach the conclusion that Lang [1980] reached by a different route. He took the position, correctly I believe, that Pareto optimality is our only theoretical definition of economic

efficiency. And he showed that demonstrating that a public policy increases private, pecuniary costs of production does not demonstrate that the policy introduces inefficiency.

He analyzes limitations on the use of feed additives by livestock producers and argues [p. 774], "In a Pareto-efficiency context, the livestock output-health risk trade-off is an intimate part of the efficiency question. The economic efficiency of livestock production cannot be evaluated independent of the level of risk." He shows that a Pareto-efficient allocation of resources can be achieved both in the presence and the absence of restrictions on use of feed additives, but that the two Pareto-efficient allocations are not Pareto-comparable. He carries out a similar analysis of the effect of limiting farms to 160 acres that use irrigation water from Bureau of Reclamation dams, and again reaches the conclusion that a Pareto-efficient allocation can be achieved in the presence and also in the absence of the acreage limitation. Many public-policy issues are like these two issues: they concern imposition or removal or relaxation or tightening of a restriction. Pareto efficiency can be achieved in the presence and also in the absence of the restriction. For example, Pareto efficiency can exist under slavery and under a system that prohibits slavery. But Pareto criteria are inadequate to determine which Pareto-efficient point is superior. The choice between the two PE points goes beyond the question of economic efficiency into the area of the public's values. Lang's formulation shows that the choice involves consideration of property rights and observes that [p. 775], "nothing in the training of economists can be used to determine which definition of property rights

is best."

Assume that item one is an input, that y_1 is the only externality that enters anyone's utility function, and that $\partial y_1/\partial x_1 > 0$ but $\partial y_1/\partial x_j = 0$ for $j \neq 1$. Let $W[U_h(X_h^*, y_1^*)]$ denote the maximum value of the SWF. Note that attaining this maximum requires that society impose a tax on the use of input one. The value of the SWF is not maximized unless producers' private pecuniary costs of production are increased by imposition of a tax on input one. Let $W[U_h(X_h^P, y_1^P)] = W[U_h(X_h^P, 0)]$ be the maximum value of the SWF if the use of input one is prohibited. And let $W[U_h(X_h^o, y_1^o)]$ be the maximum value of the SWF if input one is neither prohibited nor taxed. We know from the properties of a maximum that

$$W[U_h(X_h^*, y_1^*)] \geq W[U_h(X_h^P, 0)]$$

The effects of y_1 may be so undesirable that the excise tax on y_1 that maximizes the SWF drive x_1 and y_1 to zero. Then the equality holds. If any $T_{ijh} \neq 0$ we have

$$W[U_h(X_h^*, y_1^*)] > W[U_h(X_h^o, y_1^o)]$$

The most likely situation is that

$$W[U_h(X_h^*, y_1^*)] > W[U_h(X_h^P, 0)] > W[U_h(X_h^o, y_1^o)].$$

Then the worst public policy of all, i.e., the one that produces the smallest maximum of the SWF, is the policy that neither prohibits nor

taxes the use of input one. If society fails to restrict the use of input one, it is behaving inefficiently, i.e., behaving in a way that is inconsistent with its own objectives.

The investigators who show that some public policy that restricts use of feed additives or pesticides will result in increased private, pecuniary production costs and will therefore reduce efficiency or introduce inefficiency are able to reach this conclusion only by assuming that the externality y_1 enters no one's utility function and is not a demerit good.

From the fact that we do have environmental protection laws and have pressures for even more restrictive legislation than has been enacted, I infer two things: (a) that we do have people who are concerned with environmental quality: people whose welfare is increased by taxation of or prohibition of polluting inputs or outputs, and (b) that we can only achieve a PE situation by imposing restrictions on use of some inputs or production of some outputs.

Full Employment As A Merit Good

Model MA-7

The Employment Act of 1946 calls on the government to "promote maximum employment, production, and purchasing power." Some of the x_j in the SWF in MA-2 might be interpreted as levels of employment, with $\partial W/\partial x_j > 0$ of course. Then T_{ij} would be a subsidy paid on employment of resource j. Thus a subsidy to promote full employment, though it violates the classical PE conditions, may be an efficient device for

maximizing the value of the SWF.

It is traditional to distinguish macroeconomic goals such as full employment or control of inflation from the microeconomic goal of "efficiency". This model shows that to be a false distinction, at least so far as the macro-goal of "full" or "maximum employment" is concerned. Society has demonstrated through its passage of the Employment Act of 1946 that it is concerned with the aggregate level of employment. I do not see how any public policy study that ignores this concern can claim to have identified an efficient policy. Such a study is mistakenly using the SWF of Model MA-1; i.e., it is using a wrong SWF, one that ignores society's care about the level of employment. The study contains specification bias, to borrow a term from statistics.

One final implication of these models: We cannot hope to decide what is PE and what is not unless we know all the arguments of each individual's utility function and of the SWF.

Existence, Or Sacred, Value

In an essay that drew from national surveys and from individual's life histories, Yankelovich [1981] reported a great deal of constancy in U.S. values but also some significant trends that we economists need to recognize. He found that people are placing an increasing emphasis on sacred and expressive values and less emphasis on instrumental values. Economists are familiar with instrumental values. These values judge things by their effectiveness as means to ends. Yankelovich uses "sacred" in the sociological sense. A sacred outlook values things for themselves, for their intrinsic characteristics. Expressive values are also opposed to instrumental values. Whatever is expressive also has

value in its own right.

An employer who treats employees purely as tools for getting more output or more profit applies instrumental values. In most studies of public policy we economists adopt this same view. Employees are means to an end of greater consumer surplus, or lower cost, or most profit. We also assume that employees and employers have a purely instrumental attitude toward their own work. They neither like nor dislike jobs, they do not use expressive values to judge jobs, they just do their jobs to make money. A devout Christian employer who values employees as good workers and also as fellow human beings because employer and employee are all brothers and sisters under the parenthood of God is applying sacred values--both sociological and religious--as well as instrumental ones. An atheistic employer who values employees as fellow humans, as being important in themselves, is applying sacred values in the strictly sociological sense.

Yankelovich discusses various manifestations of the decreasing emphasis on instrumental values and the increasing importance of sacred and expressive values. Fewer people are satisfied to evaluate jobs from a purely instrumental viewpoint, which views jobs solely as a means to money and family support. More people are expecting jobs to provide challenge, satisfaction of personal accomplishment, and opportunity for personal growth. More women are working for self-fulfillment as well as for money.

The practice of using money to judge others' social standing has been declining, as has the emphasis on consumption as a method of demonstrating that one has "made it." Growth of national entitlement pro-

grams--aid to dependent children, medicare, e.g.,--the womens' movement, the environmental movement, pressure for equal pay for work of equal value: all express increasing emphasis on sacred or expressive values. Changing value systems have led to increasing concern for satisfying interpersonal relations, and for a stronger commitment to community welfare and a stronger desire for the feeling of belonging to a community.

Inglehart [1981] also reports finding a trend from Materialistic to Post-Materialistic values.

I once heard a Yellowstone Park Ranger lecturing on park management problems. After justifying their policy of hunting down and killing a grizzly bear who had attacked a camper, he said "I hope we will always have Grizzlies. I may never see one but I will feel better just knowing that they are out there. The world will be a poorer place if we kill all the Grizzlies." I agree with him; we place a sacred value on the bears; their existence is important to us. Gilbert [1984], too is pro-Grizzly and explains at length his reasons for placing a sacred value on them.

Will [1983] expressed the sentiments of many people when he wrote the following about whales.

> "It probably is virtually impossible to kill humanely a creature that large. But even if the problem of pain could be solved, this problem would remain: There is something unseemly, something subversive of our own dignity, about killing such splendid creatures.
>
> Whether or not whales, with their complex brains, really are, as some scientists say, "our neurological relations," is less important than this: Whales have individual personalities, complex social behavior, and remarkable memories and capacities for communication.

> As I sit with pen poised over paper, I am struck by the oddness of cataloging reasons for abandoning the killing--the cruel and utterly unnecessary killing--of such mysterious creatures, about which we have so much to learn. It is possible, and not exactly wrong, to give practical reasons why saving the whales will be useful. But there are times, and this is one, for rising above utilitarianism.
>
> It is important to say that life is enhanced aesthetically by the knowledge that these sociable creatures are swimming --and singing--on the surface of the sea, and in the sunless depths below. Furthermore, mankind has dominion over the Earth, but mankind's unsteady, serpentine path toward finer sentiments can be measured, in part, by evolving standards of what constitutes civilized dominion over lower animals.
>
> Surely it involves a conviction, more intuitive than reasoned, that Creation, and we as the responsible portion of it, are diminished by wanton behavior toward creatures that so stunningly exemplify the mysteriousness of the natural."

Note the expression "a conviction, more intuitive than reasoned." Most reasoned convictions are based on intuitively selected assumptions. Wills here expressed a sacred perspective.

Have you ever stood on the Snake River Plain and looked west across Jackson Lake at the Teton Range and feasted your eyes on that grand, magnificient scene? Did it ever strike you as a bit odd that that scene had no economic value, but a commercial photographer's bitty 2" by 2" slides of the scene had economic value? The Plain, Lake, and Mountain Range do not enter into our national income or national wealth accounts. But the slides do. What I have just said about the Tetons can be said about almost any tourist attraction. The attraction is valueless, its pictures are valuable. We seem to value shadow over substance.

Here we have one answer to Long's [1967] question on option value. He wondered why a potential user of Sequoia National Park would be willing to pay for an option to visit it unless there was a chance of

actually visiting it. The answer is that his question is too narrow. It is limited to "potential users." I never intend or expect to see (I am not a potential user of) live blue whales. But I am happy that they exist. The answer is that grizzly bears and blue whales and Sequoia National Park have existence value. Some of us find satisfaction in knowing that they exist and we are willing to pay to keep them in existence, just as we are willing to pay taxes to provide aid to families with dependent children even though we never intend to use or visit these families or their children. If blue whales, or grizzlies, or walleye, or bluebirds, or Sequoia disappear, my world will be impoverished; a flatter, grayer, more sterile place of less sweet mystery. I feel diminished as a person and shamed as a human being whenever the actions of the human race are responsible for the extinction of any wild creature.

Long takes an instrumental view of the Park: the Park is not valued for itself, for its parkness; it's only value is as a tool to provide persons gratification when they sightsee, camp, hike, or photograph in the park. Many of us, however, apply sacred as well as instrumental values to determine the worth of parks, whales, and bears. The natural resource economists' concept of option value is an instrumental perspective. It asks, "What is the probability of enjoying a trip to Yosemite National Park worth?" Existence value, on the other hand, expresses a sacred perspective. It values Yosemite for its Yosemiteness.

Model MA-8

In this model each person's utility function can be written as $U_h\ (X_{h,y})$ where y is something having sacred, or existence value, e.g., number of grizzly bears or blue whales. Society's transformation function is now $F(X,y) \leq 0$. From the FOC for x_{ih} and y we obtain

$$MRS^h_{iy} = MRT_{iy} + T_{iyh}$$

$$T_{iyh} = - \sum_{t \neq h} \frac{\partial W}{\partial U_t} \frac{\partial U_t}{\partial y} \quad \lambda \frac{\partial F}{\partial x_i} < 0$$

PE calls for a subsidy on the "production" or protection or preservation of wildlife or parks that have existence value. We would reach the same conclusion if we excluded y from individual's utility functions but included it as a merit good.

Concern for Equity

An individual's or a society's concern for equity (or fairness) might be depicted in various ways. Just as we cannot judge the efficiency of an agent's actions unless we know the agent's goals, we cannot judge equity of an outcome until we define criteria for measuring equity. (a) One way is to impose the restrictions $x_{jh} \geq \bar{x}_j$ for some j and all g. (b) We can limit the variance or third moment of the frequency distribution of personal consumption. (c) We can treat moments of the distribution as merit goods. (d) We can include moments of the distribution in individual's utility functions.

Model MA-9

I will choose the first. Assume for convenience that item J is the only item relevant to equity considerations. The SWF is the same as in Model MA-1. It is to be maximized subject to $x_{jg} \geq \bar{x}_j$ for all g. Let μ_g be the Lagrange multiplier associated with this restriction. From the FOC, we obtain

$$MRS^h_{iJ} = MRT_{iJ} + T_{iJh}$$

$$T_{iJh} = \mu_h / (\lambda \partial F / \partial x_i)$$

If $x_{Jh} = \bar{x}_J$, $\mu_h \geq 0$ and $T_{iJh} \geq 0$. If $x_{Jh} > \bar{x}_J$, $\mu_h = 0$ and $T_{iJh} = 0$. If a person's consumption would otherwise fall below the poverty level $\bar{x}_J$, the person's consumption of item J is subsidized. Persons whose consumption exceeds $\bar{x}_J$ are neither taxed nor subsidized.

Economists conventionally distinguish between "efficiency effects" and "equity effects". This model leads me to conclude that this is a false distinction. Individuals and society do care about fairness. No policy that ignores that concern can be an efficient policy.

Interpersonal Comparisons

Model MA-10

This section does not present a new model, but looks at previous models from a different perspective. From MA-1 we can derive the relation

$$\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{jh}} = \frac{\partial W}{\partial U_g}\frac{\partial U_g}{\partial x_{jg}}$$

This implies [Pazner, 1973, p. 466] "that the social marginal utility of income of all ... consumers is equalized at the optimum." He considers this to be "the individualistic optimality condition par excellence of the usual Paretian SWF model." But, I see another thing in the classical PE model. It imposes a strong restriction on people's utilities and thereby contains interpersonal comparisons.

We have already seen that classical PE refuses to admit certain arguments into anyone's utility function: (a) other person's levels of consumption, (b) production externalities, (c) preferences for means, (d) sacred values, (e) concern for equity. We in effect replace $\partial W/\partial U_h$ by $\partial W/\partial U_{hr}$ where dU_{hr} is the change in person h's utility from consumption of item r, and set $\partial W/\partial U_{hr} = 0$ for all h and some r. In the presence of externalities in production, e.g., we take all of person g's preferences into account if $\partial U_g/\partial y_j = 0$. But we ignore part of person g's preferences if $\partial U_g/\partial y_j < 0$. That way we can set the T_{ijh}'s equal to zero. To obtain the classical PE conditions we arbitrarily replace "unacceptable" nonzero marginal utilities by zeroes. In doing so we make interpersonal comparisons under the existence of items (a) through (e).

By our decision to exclude some elements from utility functions we are answering an ethical question that we have never consciously asked and one that we have no special competence to answer. The question is forcefully raised by Mac Rae [1976]. After raising questions about the

rationale for democracy, he writes [p. 51]

> "These questions take us into a realm between welfare economics, valuative political theory, and the ethics of other social sciences. They lead us also to ask which of an individual's existing preferences ought to be combined in a social aggregation system and which ought not. They lead, then, to a morally and politically oriented critique of welfare economics and its political extensions, making use of its technical sophistication but transcending the disciplinary bias of economists that preferences are to be taken as given."

(I have underlined the ethical question we answer without ever asking.)

He also writes [p. 69]

> "The individualistic framework in which valuations are tacitly placed is also revealed by a peculiar terminology used by economists. The formulation of criteria under which "social welfare functions"--a type of ethical system--are specified typically characterizes them as imposed by despots, dictators, or individual social scientists. This assimilation of valuative discourse to the given, unsystematized, and undebatable tastes of the consumer encourages the neglect of systematic discourse, within the political and educational systems of a society, concerning the relative merits of various valuative standards and judgments."

Someone has to decide which items ought to be included. For example, suppose some persons are "antagonistic hedonists", their utility functions are of the form $U_h\ (X_1, \ldots, X_h, \ldots, X_H)$ but $\partial U_h/\partial x_{jt} < 0$ for all $t \neq h$: the more that others have, the less well-off is person h. Are antagonistic preferences to be allowed into a SWF? (For my universal hedonists, $\partial U_h/\partial x_{jt} \geq 0$ for all $t \neq h$ and the strict inequality holds for some j and t.) The choice of items to include is not an economic question. Economists are no more competent to answer it than other citizens. And are probably less competent to answer it than philosophers. The choice of items is a public policy issue.

It seems to me that public policy makers need more information than that some outcome is PE. They would want to know whether the SWF that is maximized is a desirable or an undesirable function. The knowledge of equality between MRS and MRT tells us nothing about the nature of the SWF that is maximized.

As I understand it, one of the attractions of classical PE is the perception that its use allows us to compare desirability of (some) situations in a "scientific manner" which apparently means without the need for value judgments. As we see, this is a false perception. The FOC are necessary conditions for PE solutions to the problem of maximizing a SWF. And these necessary conditions impose restrictions on ratios of marginal social value and on marginal utility. It is necessary to satisfy certain interpersonal comparisons in order to have a PE solution. These interpersonal comparisons are value judgments.

The actual situation, then, is the polar opposite of the perceived situation. PE considerations do not dispense with value judgments. They require them. We need to note, too, that the decisions to use a SWF and PE are themselves value judgments.

If it is not legitimate for us to make interpersonal comparisons in order to compare PE points, why is it legitimate for us to make interpersonal comparisons in order to identify PE points? Quite aside from the issue of legitimacy, we are not competent, and should not be trusted, to make interpersonal comparisons.

No One Worse Off Compared With What?

Model MA-11

I earlier argued that the relevant meaning of "better, or worse, off" for public policy study is "better, or worse, off than under the status quo." If we know that some people will be better off, and no one worse off, under possible policy A than under hypothetical policy B, then we may conclude that A is superior to B. But we will hesitate to recommend replacement of present policy by policy A until we determine that A is Pareto superior to the present policy. To incorporate into PE the restriction that no one is to be made worse off than under the status quo, we may proceed in various ways, depending upon how we intrepret "better, or worse, off than under the status quo." One way would be to append to Model MA-1 the constraints $U_h(X_h) \geq \bar{U}_h$ where $\bar{U}_h$ is the h-th person's current level of utility. Then a typical (interior) FOC would be

$$\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{jh}} - \lambda \frac{\partial F}{\partial x_j} - \mu_h \frac{\partial U_h}{\partial x_{jh}} = 0$$

And we would have the classical PE conditions $(\partial U/\partial x_{jh})/(\partial U/\partial x_{ih}) = (\partial F/\partial x_j)/(\partial F/\partial x_i)$: $MRS_{ij} = MRT_{ij}$ everywhere. Knowing that a situation satisfies this equality everywhere does not tell us if we have a solution in which no one is worse off than at present. The only way to determine this is to test that the situation satisfies the constraints $U_h(X_h) \geq \bar{U}_h$. Because we do not check the constraints, our classical PE treatment of maximizing a SWF is only appropriate for comparing hypothetical policies under the "no one to be worse off restriction." In comparing possible outcomes with existing outcomes, if we do not impose or

test such restrictions we are implicitly admitting the possibility of making some persons worse off than under the status quo.

There is still more to the story. Suppose a policy does not make person h better off but does make person g better off. Then we know from the Kuhn-Tucker conditions that $\mu_h > 0$ and $\mu_g = 0$. Let $\mu_h > 0$. Then

$$\frac{\partial W/\partial U_h}{\partial W/\partial U_g} = \frac{\partial U_g/\partial x_{jg}}{\partial U_h/\partial x_{jh}} - \mu_h \frac{\partial U_g/\partial x_{jg}}{\lambda \partial F/\partial x_j}$$

Compare this with the result we obtain if μ_h and μ_g are both zero.

$$\frac{\partial W/\partial U_h}{\partial W/\partial U_g} = \frac{\partial U_g/\partial x_{jg}}{\partial U_h/\partial x_{jh}}$$

$\partial U_g/\partial x_{jg}$ and $\lambda \partial F/\partial x_j$ are both positive. $\partial W/\partial U_h$ is person h's marginal social value. These expressions say to me that a PE policy implicitly assigns increased marginal social value to the persons benefitted by the policy. Alternatively they say the obvious thing: To assure that the policy that will be chosen will benefit members of an identified group, be sure to assign each member a large marginal social value.

Model MA-12

Another way to incorporate status quo restrictions is to incorporate initial stocks of wealth (human and nonhuman, production and consumption items) and a time dimension. Because there is an upper limit on the amount of time that people can spend in producing, consuming, and exchanging, there is a limit on the proportion of initial stocks that a wealthy person can dispose of, and also on the amounts

that a poor person can acquire. We can therefore impose on each person a restriction $\tau_h(X_h - Z_h) \leq 0$ where Z_h is a vector of initial stocks. Person h cannot maximize $U_h(X_h)$ if he does not have sufficient time to supply flows of services, x_{jh}, from his stocks, Z_{jh}, and time to acquire sufficient consumption goods to reach an unrestricted maximum of U_h.

Then the Lagrangean is

$$L = W\big(U_1(X_1),\ U_2(X_2),\ \ldots,\ U_H(X_H)\big) - \lambda F(X)$$

$$- \sum_h \mu_h\ \tau_h\ (X_h - Z_h)$$

And

$$\frac{\partial W}{\partial U_h}\frac{\partial U_h}{\partial x_{jh}} = \lambda\frac{\partial F}{\partial x_j} + \mu_h\frac{\partial \tau_h}{\partial x_{jh}}$$

Then

$$MRS^h_{ij} = \frac{\lambda\ \partial F/\partial x_j + \mu_h\ \partial \tau_h/\partial x_{jh}}{\lambda\ \partial F/\partial x_i + \mu_h\ \partial \tau_h/\partial x_{ih}} \neq MRS^g_{ij}$$

In this model, in contrast with MA-10, $MRS_{ij} \neq MRT_{ij}$.

The results from MA-11 and MA-12 suggest the following hypothesis. A solution that satisfies classical PE conditions need not satisfy the requirement that no one be made worse off than at present; and any situation that can be shown to satisfy this requirement does not meet classical PE conditions.

IS PERFECT COMPETITION PE?

A standard position is presented by Intrilligator [1971, pp. 277-

279]. "The first basic theorem of welfare economics states that a competitive equilibrium is a Pareto optimum...." And "The second basic theorem of welfare economics states that any Pareto optimum can be realized as a particular competitive equilibrium...." He cites four assumptions used to obtain these theorems: (a) consumer preferences are convex and nonsatiating, (b) production possibility set is convex, (c) the absence of externalities, and (d) existence of public goods.

In models MI-5, -6, and -7, and in Models MA-2, -3, -4, -6, and -7 we saw why the assumption of absence of externalities is important to the proof of these theorems of welfare economics. In the optimal solutions to these models consumers have different MRS's, and/or firms possess different MRT's, and/or consumer MRS ≠ firm MRT. Under perfect competition, a single price exists for a homogeneous item. If all firms and all consumers face the same price ratio, the FOC for these models are not satisfied. We also saw that if firms value means as well as ends (in MI-2 and MI-4), if merit wants exist (in MA-2; -3, and -7), or if the "no worse off" restriction is defined one way (in MA-10), then different consumers have different MRS and different firms have different MRT. We also saw that a competitive outcome is not PE if some people apply sacred standards (in MA-8), and is not PE if individuals or society care about equity (in MA-9).

In sum, we find a variety of situations of perfect knowledge in which perfectly competitive outcomes are not PE because PE requires imposition of taxes (or subsidies) to make MRS and MRT unequal. (In addition various writers, e.g., Newberry and Stiglitz [1981] have shown that a competitive market need not be efficient in the absence of a

complete set of futures and risk markets.)

I believe in the existence of public goods, externalities, merit wants, economic agents who value means as well as ends, and sacred perspectives, and concern for equity; and therefore I conclude that the two theorems may be elegant and/or aesthetically satisfying, but do not apply to any real-world situation.

INTERTEMPORAL ISSUES

In principle I guess we can modify any of the previous MA Models to incorporate intertemporal choices. We can allow different subscripts to identify the same product during successive time intervals and modify F(X) appropriately. If we reformulate the models of merit goods, universal hedonism, externalities, etc. to represent intertemporal issues, we seem to be driven to the conclusion that a competitive capital market does not provide an interest rate that is appropriate for discounting public investments. If we assume a competitive capital market equates intertemporal MRS and MRT, it follows that the market violates the PE conditions. The PE conditions require that intertemporal MRS and MRT differ by the T_{ij}'s or T_{ijh}'s.

ORDINALITY VS. CARDINALITY

One debate has concerned cardinality vs. ordinality of SWF and individual utility functions and the issue of interpersonal comparability. After summarizing major contributors to the debate, Mueller [1979, pp. 180-181] concludes

> "Thus, the proper interpretation of W based on the original presentations of Bergson and Samuelson and this most recent debate is I believe, (1) that ordinal utility functions are sufficient as arguments of W when deriving the necessary conditions for a Pareto optimum, (2) that cardinal, interpersonally comparable arguments are required to select a single, best point from among the infinity of Pareto optima, and (3) that W is, in any case, ordinally defined."

Mueller's second point is correct but inadequate. I have already argued that our decision to treat everyone as an egoistic, monetaristic hedonist results in interpersonal comparisons. We discriminate against everyone who is not an egoistic monetaristic. Each infinity of Pareto optimum contains interpersonal comparisons.

His third point is inadequate if there exist merit goods--as discussed in MA-2 and -3, if full employment is a merit good, if sacred values or equity considerations create merit goods, or if externalities are demerit goods. Under these circumstances ordinal utility functions are adequate and the SWF can be ordinal in the x_{jh}'s but must be cardinal in the x_j's. To see this, consider Model MA-2. Suppose the ordinal index $U_h(X_h)$ is replaced by a monotonic transformation $V_h(X_h)$. We can replace W[.] by a monotonic transform R[.] such that $(\partial W/\partial U_h)(\partial U_h/\partial x_{jh}) = (\partial R/\partial V_j)(\partial V_h/\partial x_{jh})$. In doing so we obtain

$$MRS^h_{ij} = MRT_{ij} + T'_{ij}$$

$$T'_{ij} = -\frac{\partial R/\partial x_j}{\lambda \partial F/\partial x_i}$$

And $T'_{ij} = T_{ij}$ for a given distribution of goods and services if and only if $\partial R/\partial x_j = \partial W/\partial x_j$. In a society that contains merit goods, the SWF

must be cardinal in its merit good arguments. For a given set of individual and social preferences and a given transformation function, replacing one SWF index that is ordinal in merit goods by another ordinal index will result in a different set of FOC.

IMPLICATIONS OF THEORY OF SECOND BEST

In these models we have identified some conditions that make classical PE outcomes inefficient. There also exist other conditions in some sectors of an economy which make classical PE outcomes impossible in these sectors and hence, by the theorem of second best, make PE outcomes inefficient in other sectors.

If some optimality conditions cannot be satisfied, e.g., MRT's cannot be equated, then a first best solution is not possible. We can obtain a second best solution by optimizing subject to the constraint that MRT's are unequal. If some first best optimality conditions cannot be satisfied, requiring the others to be satisfied may not be desirable because it does not provide a second best solution. It provides at most a third best solution.

For example, various writers [see, e.g., Baumol and Klevorick, 1970] have demonstrated that regulated monopolists that are subject to binding fair-rate-of-return constraints do not use the cost-minimizing combinations of labor and capital. They do not use the PE combination of inputs. Satisfying the FOC for PE elsewhere in the economy does not provide a second best outcome.

The existence of sales and excise taxes interferes with the attainment of classical PE conditions. Some excise taxes may, however, be

justified as taxation of demerit goods. The existence of an underground economy interferes with satisfaction of any PE conditions, classical or otherwise.

Taxes

Another obstacle to the achievement of classical PE is taxes. In states where foods are not subject to sales tax but nonfood items are, consumers equate MRS to the negative of (food price)/(nonfood price plus sales tax), whereas firms equate MRT to the negative of (food price)/(nonfood price). The difference between the two ratios means that MRS ≠ MRT and classical PE conditions are not satisfied. The same thing can be said about excise taxes and income taxes: they cause deviations from classical PE conditions. They also cause deviations from PE conditions in other models. Now, what other deviations from PE conditions will produce a second-best situation in the presence of these tax-induced deviations from PE? A few taxes, e.g., excise taxes on cigarettes and liquor, may be justified as taxes on demerit goods.

Underground Economy

The existence of the "underground" or "cash" or "subterranean" economy creates similar difficulties. (The following material on the subterranean economy is from Bawly [1982]). His preferred definition of the subterranean economy is [pp. 6-7]: "that part of the gross national product that is not measured by official statistics." It includes the following: funds derived from criminal action, funds derived from breaking foreign currency control laws, funds derived from illegal work,

and funds derived from untaxed extraterritorial economic activities. Employees in the subterranean economy avoid income tax and social security liabilities. Employers avoid social security contributions on their employees' and their own incomes, income taxes, unemployment fund contributions, sales taxes, license fees, and paper work. Bawly writes [p. 117] that a New Yorker who wants a legal taxi business must pay $60,000 for a taxi license. "No wonder many, mostly Blacks and Hispanics, have ignored the city-granted monopoly and entered a 'gypsy' taxi industry, where they earn an honest, hard, albeit illegal, living." And he also writes [pp. 119-120] "The complexity, range, and number of tax reports required of a new, young sole proprietor of a business being set up in the city of New York, for instance, can easily lead him or her to despair. Assuming the owner lives in any one of the five boroughs, he or she is liable for no less than twenty (!) different taxes or statements, and if two or more staff are employed, he or she must file at least thirty-seven separate tax reports annually." We do not know the size of the subterranean economy. But Bawly [p. 115] presents one estimate that the portion of the U.S. subterranean economy that filed no income tax returns in 1972 involved about five million persons who received about $30 billion in taxable income. He also reports [p. 113] a 1980 estimate of five million Americans who were legally obligated to pay income taxes who paid none and whose aggregate income may have been over $300 billion. For additional material on the underground economy, see Carson [1984].

A firm in the above-ground economy uses amounts of labor of two types to equate its MRT to the negative of (wage rate 1 + fringe benefit

1)/(wage rate 2 + fringe benefit 2). A firm in the subterranean economy equates its MRT to the negative of the ratio between wage rates. The two firms have unequal MRT, and PE conditions are not satisfied.

Law Making

There exist a number of activities in which PE conditions cannot be known to be satisfied or even be known to exist because their outputs are not measurable. Consequently we do not know whether it is desirable to satisfy PE conditions (classical or otherwise) in other sectors of the economy. One of these activities is law-making. Theory of second best does not help us hire because it deals with nonsatisfaction, not nonexistence, of PE conditions.

Many public policy questions concern imposition or relaxation of constraints to achieve public goals. PE criteria are generally not sufficient to determine the efficiency or desirability of such constraints because a PE solution exists in the presence of the constraints and a different PE solution exists in their absence. And the two PE points are not comparable on Paretian criteria.

This is easily illustrated by going back to Model MA-1 and first adding the single restriction $H_1(X) \leq 0$, and then replacing it by the restriction $H_2(X) \leq 0$. The two sets of FOC and the SOC will differ but each set provides a maximum. And PE criteria are insufficient to identify the preferred situation. If $H_1(X)$ is effective, imposing it reduces the maximum value of the SWF below the value attained in Model MA-1. Even so, we cannot conclude that imposing $H_1(X)$ created inefficiency or reduced welfare. Imposing $H_1(X)$ may be the best way

that society has of achieving a desirable objective. A restriction that society chooses to impose upon itself can be viewed in terms of lexicographic utility. Society may decide that its first goal is to satisfy $H_1(X) \leq 0$. Only after this goal is met will it seek to maximize SWF. The $U_h(X_h)$, SWF, and $H_1(X) \leq 0$ all represent persons' preferences. As economists we are no more competent to judge $H_1(X)$ than $U_h(X_h)$ or the SWF.

The laws may not result in mathematical restrictions. They may spell out public responsibilities in the area of merit goods or in other ways specify a change in the SWF from $W(\cdot)$ to $V(\cdot)$. Certainly we are not competent to tell society that one SWF is superior to another. This leads me to conclude that we can never identify a complete, exhaustive set of conditions for PE.

Every year we experience substantial expenditures--legal, political, governmental; on judges, lawyers, expert witnesses, law clerks, governmental agencies, legislatures, lobbyists, etc.--to determine constraints to be imposed on the system. These constraints can be in the form of legislative, judicial, or administrative laws. Variations in constraints--imposing, removing, relaxing, tightening--create situations that are not Pareto comparable. That is, we cannot determine Pareto efficiency of variations in constraints. Consequently we have no criteria for determining PE of resources used in determining these constraints. Likewise we have no criteria for testing PE of use of resources in political campaigns: where we choose the people who determine the legal constraints.

The earlier discussion of interpersonal comparisons is relevant

here because, after all, one essential element of law-making is the forming of interpersonal comparisons. And this leads me to a disquieting observation: congressmen are more scientific than we economists are. In formulating laws, they hold public hearings to learn peoples' attitudes, preferences, beliefs, and values. In essence what we do is to ignore this information that people could provide us about what they are like and we go back to see what Marshall told us people are like. We make the same assumptions about human motivation that Marshall made a century ago. The sociologists have provided abundant evidence that attitudes, values, and preferences have changed. So we are studying people who have been dead for decades in our efforts to determine what will be desirable for people living in future years. How can we possibly know what policies will make some people better off without making others worse off unless we know what people value? And how can we know this when we never try to find it out?

R and D

There are a number of activities whose existence is not even recognized by PE analysis. In his history of General Motors, Alfred Sloan [1963, p. 150] who was G.M.'s chief executive officer for twenty-three years and a member of its board for forty-five years, wrote

> "As the economy, led by the automobile industry, rose to a new high level in the twenties, a complex of new elements came into existence to transform the market once again and create the watershed which divides the present from the past. These new elements I think I can without significant loss reduce to four: installment selling, the used car trade-in, the closed body and the annual model. (I would add improved roads if I

were to take into account the environment of the automobile.)"

Many of our business activities--promotion, advertising, public relations, product differentiation--are intended to change consumers' MRS among products. PE criteria take MRS as given data. How do we measure the PE of resources used to change things assumed constant in developing Paretian measures? How can we simultaneously test equality of constant MRS and compare changes in these MRS with MRT of activities designed to effect changes in MRS?

Similarly, substantial amounts of resources are devoted to bringing about technical change: research and development expenditures. PE criteria treat MRT in production as parameters. How do we simultaneously test equality of constant MRT and compare changes in these MRT with the MRT of activities intended to change them?

All businesses devote resources to procurement and marketing activities: to exchange of ownership. We have neither production nor cost functions for these activities. Consequently we cannot test the PE of resources devoted to these activities.

Similar questions can be raised about the information and education industries.

Until we exercise our omniscience and develop criteria for determining PE in these legal, advertising, R and D, and education activities, we cannot know that these activities satisfy the conditions for PE. So long as we cannot know this, we cannot know that it is desirable to have PE everywhere else. Having PE everywhere else may be inefficient.

Now suppose that criteria for determining PE of these activities of

law, advertising, R and D, and education do not exist. It is an open question whether (piecemeal) PE is desirable in other sectors when it is not known if PE can even exist in these activities. One's answer to the question is now a question of faith and scientific taste: of values.

Public Services

If no government exists to provide life and property protection to the firms in Figure 1, each firm must set aside some of its own resources for its protection against fire, theft, and fraud. How much should it set aside? If a government provides the protection, the same question must be asked. Now we have additional PE conditions. Theory of second best tells us that if these conditions are not satisfied it is not desirable to equate MRT to MRS elsewhere. We can not know whether these conditions are satisfied because we can not measure amount of protection. Consequently PE criteria for protection do not even exist. Because they do not exist we can not know that it is desirable to satisfy PE criteria for private goods.

The "protection" of this analysis is an example of the many publicly provided goods: fire and police protection, national defense, court system, law making, international affairs, education, public R and D, public roads and airports, federal grades and standards: Rausser's [1982] PERTS -- political economic resource transactions. If we allow protection to be privately provided, then it is also an example of private R and D; selling, advertising, and promotion; and political campaigns. Thus we can conclude: Because there are large sectors of

the economy in which PE can not be known to be satisfied, or even to exist, we do not know that it is desirable to satisfy PE conditions (classical or otherwise) in the other sectors of the economy. Samuelson's vertical summation of demands does not solve the problem. His summation requires that output be measurable.

Governments Should Be Inefficient

Some economists seem to be convinced that governments are inefficient. These people should maintain that satisfaction of PE conditions for private goods is undesirable. Granted, if there is inefficiency in government we may not know what deviations from PE are desirable elsewhere. But we do know that some deviation from PE is desirable elsewhere and that having PE everywhere else is not a second-best situation. And we know that if we do have Pareto inefficiency elsewhere we may have a second-best situation.

Some economists maintain that, because governments manage some things inefficiently--e.g., public lands, public schools, public highways--these things should be owned by private firms. The idea is that the private firms will manage these things efficiently. I find their arguments unconvincing. I assume that governments will continue to perform some services, e.g., law-making and enforcement, international relation, national defense. So long as governments retain some responsibilities, we know that PE elsewhere is not desirable unless government is PE. And we cannot know that government is PE. One reason is immeasurability of outputs. Another reason concerns military procurement. According to Tobias et al. [1982, p. 254] the United States has but one

producer of some big-ticket defense items: Trident submarine, aircraft carriers, tanks, armored personnel carriers. And seventy percent of all military procurement is through sole-source contracts or otherwise without competitive bidding. How do we assure ourselves that PE exists in these bilateral monopolies? How can both the Defense Department and the arms monopolist behave like price takers? And we cannot be sure that resources devoted to weapons development are used in a PE manner.

Given the existence of public activities whose PE cannot be tested, then, we cannot know that PE is desirable in management of public lands, schools, or highways. The position that PE is desirable in these activities is not logically proven nor factually established. It is a matter of faith.

But, of course, to argue that these things should be managed privately and not publicly because only the former assures efficient management misses a basic point, one that Bromley [1982] brings out. Society has wisely decided that some resource-allocation decisions are too important to be entrusted to businessmen. Some things are so much more important to society than what economists conventionally call "efficiency" that their achievement is worth the sacrifice of a great deal of "efficiency".

Here I am essentially restating some of my earlier arguments. These economists are able to conclude that private ownership is superior to public ownership only because they use an irrelevant SWF; they exclude merit wants, universal hedonism, externalities in production, and sacred value. And, of course, the fact that private ownership will provide a PE outcome does not tell us that private ownership is desir-

able. The particular outcome that will eventuate under private ownership may be less desirable than the present (presumably non-PE) situation.

We also need to ask of people who complain that government is inefficient, How desirable is efficient government? In late 1983, newspapers were reporting on efforts by the Reagan administration to require the Census Bureau and the Internal Revenue Service to share their data with other agencies. The Census Bureau and IRS opposed data sharing. The data-sharing was defended on the basis of efficiency. Other government agencies would have to make fewer special surveys. C.L. Kincannon, deputy director of the Census Bureau, argued that efficiency is not the primary purpose of government.

TOTAL VS. MARGINAL CONDITIONS

We must distinguish between total and marginal PE conditions. An economy that satisfies marginal conditions for PE is not maximizing its efficiency if the available resources and knowledge would permit it to achieve a higher value of social welfare by replacing some products or technologies by others, or by reorganizing each centralized corporation into a decentralized organization, or by reorganizing firms' capital structures, or by eliminating any of the four methods of competition that Sloan listed, or by introducing new methods of competition, or by legislatively abolishing the advertising industry. (What criteria would you use to judge the desirability of the last action? Abolishing advertising is, inter alia, a redefinition of property rights; it limits the ways in which firms use their resources.)

UNRELIABILITY OF MEASURES

We have more empirical information on marginal physical products and marginal rates of substitution in agricultural production than anywhere else. And even here the evidence indicates that our estimated MRT (and consequently our PE points) have large confidence intervals. Doll, Jebe, and Munson [1960] reported standard errors of MRS ranging from 8 to 33% of the MRT. In Fuller's study [1962], the upper limit on the 95% confidence interval was as much as 66% larger than the lower limit. These results were obtained under the assumption of known functional form. And that's a highly questionable assumption. Most production function studies find several functional forms that are acceptable on both empirical and theoretical grounds.

MISCELLANEOUS

The assumptions that we use to derive PE measures as measures of welfare are inconsistent with the data. Half or more of our econometric tests of hypotheses of homogeneity, symmetry, negativity, and additivity of demand functions reject the hypotheses. This implies rejection of the assumptions from which they are derived. These rejected assumptions are the same ones that we use to justify our interpretation of PE measures as measures of well being. How do we justify our continued use of measures that are derived from rejected assumptions?

My work in theory of cooperative enterprise convinces me that the proper "price" to use for cooperative transactions with members is not a

price received; the appropriate measure is price received plus expected patronage refund.

SUMMARY

From our little exercises we identified several conditions under which classical PE solutions are in fact inefficient.
classical PE solutions are in fact inefficient.

a. Some persons prefer some means of attaining their goals over others.

b. Some firms have limiting resources.

c. Merit wants exist.

d. Some consumers' utility functions contain other persons' levels of consumption as arguments.

e. Externalities affect some firms' production functions or consumers' utility functions.

f. Some people apply sacred values.

g. There exists concern for equity.

We have also seen that the last five of these conditions require public intervention in order to achieve PE outcomes. Under these conditions, individualistic utility maximizing decisions lead to outcomes that systematically differ from PE outcomes. We also found that the existence of public actions, whose outputs are not measurable, create the possibility that it is not desirable to have PE outcomes elsewhere. The existence of merit goods requires that the SWF be cardinal in its merit good arguments. The surprising result is that PE outcomes are impossible without government action and perhaps neither

desirable nor possible in the presence of government action.

I am also surprised at another result. Earlier I wrote that one's answers to the questions "Is PE desirable? Useful? Efficient?" would depend upon one's values and beliefs. It is my belief that the conditions that make classical PE outcomes inefficient--among them being merit goods--are common. The SWF must be cardinal in its merit good arguments. Until I am convinced that a cardinal SWF can even exist, I will argue that PE outcomes are impossible of attainment.

I believe that economists have neither the competence, the responsibility, nor the authority to make interpersonal comparisons and to base policy studies on our comparisons. I conclude that PE is not a useful concept because classical PE outcomes are neither desirable nor useful but they are the only PE conditions that can possibly be operational. To operationalize the optimality conditions of the various models in this paper, one must measure utility functions, transformation production functions, and values of Lagrange multipliers. See, e.g., T_{ij} in SWF, Model MA-2.

I have also argued that identifying a particular situation as PE is not informative because it does not tell society whether the SWF that is maximized is a desirable or undesirable SWF. Identifying a hypothetical policy as PE is not informative either because it does not tell us if the hypothetical situation makes some people worse off than under the status quo.

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